Computer Age

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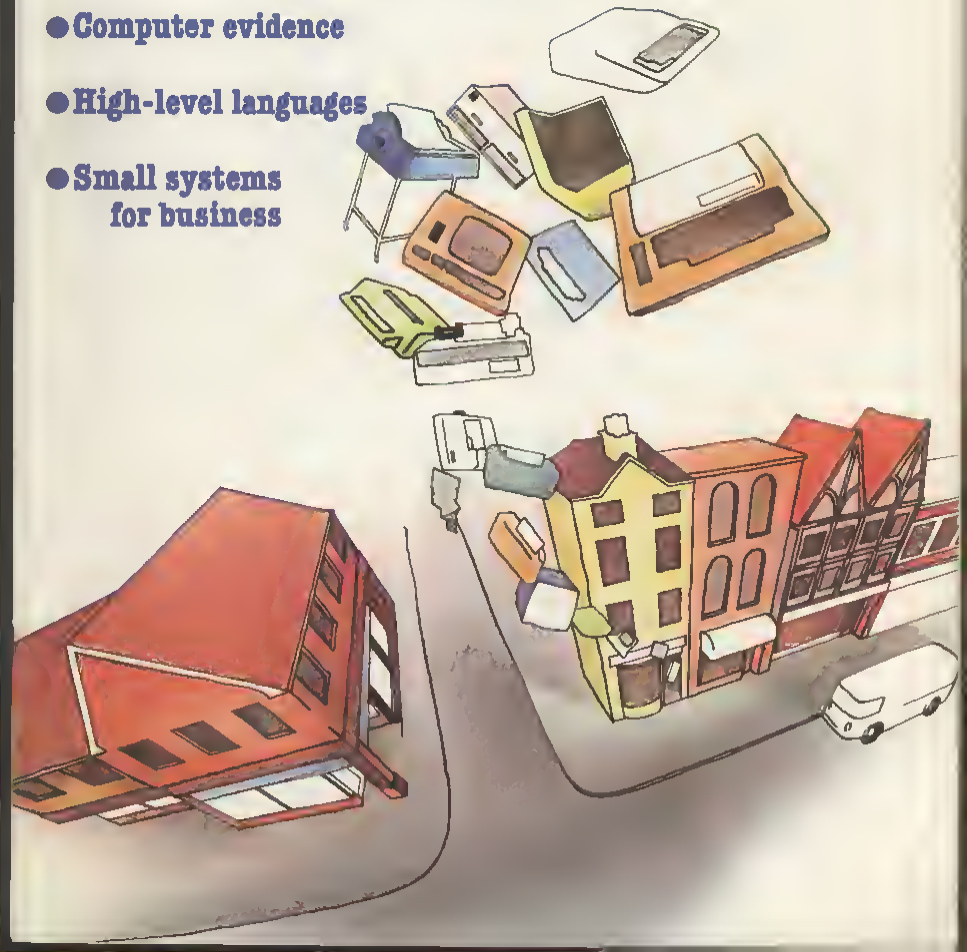

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Editorial

Technology and the future

It is now a platitude to say that the modern world has been shaped by technology and equally platitudinous to blame technology for many of its shortcomings. I would be inclined however to say that perhaps it is the neutrality or ambiguity of technology that makes our futures appear so uncertain.

Technology may indeed contain the seeds of man's liberation but it surely also contains those of his destruction. Thus a microprocessor at the heart of a piece of high-technology medical equipment or in an automaton performing a once boring and dirty job is equally at home guiding an independently targetable warhead or ousting somebody from a job.

The primary purpose of technology at least to the man in the street is to lighten the burden of work he has to carry in order to stay alive and develop his potential. For the fortunate at the present time personal development goes hand in hand with the development of technology — it is to such people that the computer press is chiefly addressed.

However if we are not to be drawn fatally to the negative pole of the technological ambiguity at least an awareness of the problems is required. Computer Age got off to a fine start in developing such a perspective in the very first issue with the article by Clive Jenkins.

As Computer Age's new assistant editor I am concerned to see that it remains a critical aware magazine and to this end once again extend an invitation to all our readers to send letters or contributions on any aspect of computing that interests or concerns them.

Anthony Esgate
Deputy Editor

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Computer Age is published monthly by Computer Age Limited, 4 Valentine Place, London SE1. Tel: 01-928 6394. Directors: John Freshwater, Kenneth Stubbs. © Computer Age Limited. **Distribution by Moore Harness Limited**, 50 Eagle Wharf Road, London N1. Tel: 01-251 8224/5. Printed by Kentis Printing Limited, 12 Foulsham Place, London W14 1HH. Subscription rates for Britain and the Continent £7.20 for twelve issues, inclusive of postage and package.

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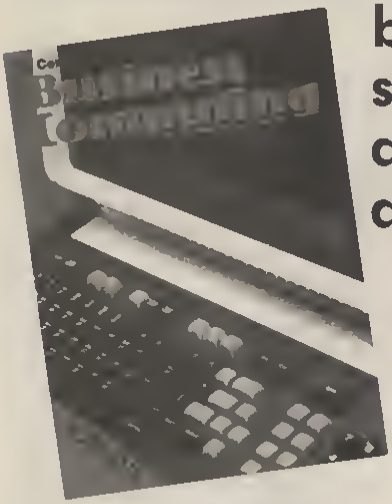

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TECHNOLOGY FOR WHAT?

Returning to one's destiny is known as the constant
Knowledge of the constant is known as discernment
Woe to him who wilfully innovates
While ignorant of the constant

Lao tzu (XVI)

Some years ago I was at a meeting at which a pioneer of modern computing — he had worked on ENIAC — was introduced as 'one of the world's greatest computer experts' he hastened to deny the possibility of any individual today being an expert in this field He was right: the facets of information processing that the computer revolution reveals draw practitioners into ever new territories of human knowledge and activity ranging from the physics of semiconductors and lasers to the mathematical logic of the abstract theory of machines The progeny of this revolution who have been bold enough to innovate these new disciplines seem however to lose their nerve when it comes to social and economic problems An exception though, was Norbert Wiener

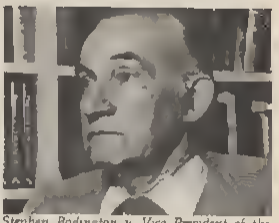
In his introduction to 'Cybernetics' written in 1947, he recognised that the modern ultra-rapid computing machine was in principle an ideal central nervous system to an apparatus for automatic control' This new development had, he said, "unbounded possibilities for good and evil' It gives the human race a new and most effective collection of mechanical slaves to perform its labor However any labor that accepts the conditions of competition with slave labor accepts the conditions of slave labor, and is essentially slave labor The key word of this statement is *competition* It may very well be a good thing for humanity to have the machine remove from it the need of menial and disagreeable tasks or it may not I do not know It cannot be good for these new potentialities to be assessed in the terms of the market, of the money they save and it is precisely the terms of the open market, the 'fifth freedom', that have become the shibboleth of the sector of American opinion represented by the National Association of Manufacturers and the Saturday Evening Post. I say American opinion, for as an American, I know it best, but the hucksters recognise no national boundary

He feared for the bulk of humanity whose skills few would find worth buying in competition with electronically controlled apparatus Pessimistically and with few hopes for its realisation he stated his own belief that 'the answer is to have a society based on human values other than buying and selling

People who should know better — Clive Jenkins for example in Computer Age No 1 — speak as if the main value of the chip was to improve our economic competitiveness. But he does not show how at the same time as giving priority to competitiveness, we can saddle this competitive economy with lavish handouts to the unemployed which is what he co-authoring with Barrie Sherman advocates in 'The Collapse of Work' Somewhat similar problems stem from Derrick Grover's proposal (Computer Age No 3 p 9) to pay a basic wage to both the unemployed and the employed an excellent idea that has my enthusiastic support but Derrick Grover and Clive Jenkins must recognise that production geared to free provision of basic human needs has to be very differently structured and motivated from production geared to making profits on a world market In other words, the propensities of transnational companies (which account for the lion's share of our production and at present set the pace for all industry) will not automatically ensure that the technological potential of this computer age is made to serve desirable social ends What kind of socio-economic structures and motivations could help us to use our productive powers to eliminate basic poverty — a goal that I, Clive Jenkins Derrick Grover and many others seem to have in common?

This is a big question and here I can do no more than make a first meagre contribution — two observations basically — in the hope of evoking thoughts from others In my view what we need is a far-reaching, searching and rigorous debate about positive economic alternatives to *competition*, to economic relations articulated by markets motivated by profit criteria, with rewards and penalties measured in terms only of money Strikes wars and misery may well be the social price that will have to be paid if an honest look at these issues is evaded, and social disasters are no less real than the mechanical disasters we risk if material stresses are not honestly analysed. I would urge computer people to embark upon this debate with the same courage and energy they have shewn in other fields opened up by the information revolution

The first of my observations is about technology as such Many write as if each new technology sprang like Athena fully-armed from the head of Zeus leaving us poor mortals to live with it for better or for



Stephen Bodington is Vice President of the Centre for Alternative Industrial and Technological Systems

worse! The reality is not at all like that, technologies are designed by human beings for use by human beings in specific structures of human relationships The designer from the moment he takes pen or pencil in hand is designing not merely apparatuses but also social relations appropriate to their use That many designers are totally unaware of this fact does not invalidate it the designer works usually to specifications provided by an institution (e g a company anxious to maximise productivity or to mechanise certain human skills) and the institution when specifying a design requirement implicitly specifies social relations for its use

The point is very well made in an article in Automatica (Vol 13 1977) on 'The Future of Control' by Professor H H Rosenbrock of UMIST He draws a sharp contrast between (a) algorithmic methods of synthesis which eliminate the skill of the designer and (b) methods that use the human capabilities of the designer (that is his human assessment of complicated situations and his ability intuitively to leap towards new solutions) *interactively* with the power of the computer in analysis and numerical computation He believes — and I feel sure he is right — that analogous contrasts may be drawn in industry generally and those that enhance it and enrich the worker's control over operations in which he participates

I am not arguing that technology in a capitalist society is capitalist technology and in a feudal society feudal technology, but rather that technical and scientific knowledge when used is always specific and in application is modified adapted and developed so as to be compatible with the social and economic relations that coordinate the users In today's information revolution there are elemental kernels of scientific knowledge and know how that transcend today's social structures The logical and mathematical work of Babbage Boole Russell, Turing and others is a quarry of social knowledge capable of application in many different ways in many different social structures The same may be said of electronics and the physics of semiconductors lasers holographis and so forth Technological design drawing on these storehouses of social knowledge and experience creates

systems and apparatuses that require in use specific structures of social relationships (Note I say structures there is of course not a one-one relationship between design and social structure — a hammer may be designed to serve a DIY enthusiast at home and at the same time be used in a factory structured around conveyor belt production)

Managers of a capitalist complex of companies or indeed of any institution organised by the criteria and motivations of profitable production and disciplined by monetary criteria, will seek to use science and technology to enhance efficiency according to these criteria This is not merely rational it is dictated by the structure within which the decision makers find themselves However it would be altogether wrong to assume that technological design as moulded by the rationality of efficiency measured in terms of commercial success must necessarily be the *socially best* technological design The rationality of capital invested in the now increasingly dominant transnational companies would seem to dictate to technological change three overriding purposes (i) reduction of costs in particular enabling a smaller input of labour time to produce a greater output of products (ii) release of capital from dependence on particular labour skills and so enlarge the usable labour force as regards training and geographical location (iii) replacement of labour in control of processes by artificial intelligence robots automation and so forth

Rationalisation of capital turnover very naturally looks for technologies that eliminate the vagaries of human nature But as between the rationality of capital using technology to eliminate the human element and the dependence of human individuals upon capital there is a horrifying contradiction. the more successful capital is the more human beings become dependent upon it as ultimate source of employment and as source of consumer goods, but by the same token capital's success goes hand in hand with dehumanisation of productive processes Norbert Wiener's words in 1947 may have seemed to be an exaggerated aside on a peripheral problem, but *in essence* is not his slave labour problem now beginning to look central and real?

This brings me to my second observation As you will have noticed, I am not enamoured of free market economics but had I lived two hundred years ago I certainly would have regarded Adam Smith as a great guy His ideas helped to make flow many currents of social progress for all the many things to be said against the greed and scramble of the market and a money dominated world, the forces his ideas helped to liberate have brought very real material and spiritual freedoms to many people and opened up conceptions of rich variegated democratic societies such as were inconceivable in his day That was two hundred years ago but it still is worth asking how to keep what is good and get rid of what is bad in the legacy of his free market

Viewpoint

If democracy is to come of age we need not wait for some new Adam Smith but should look to people themselves, and they are I believe suggesting we look in new directions where new solutions may be found People in institutions and in community life — the instances may still be few but they are becoming more numerous — are asking such questions as "Where is the organisation I work for heading? What is its social purpose?" Often this interest is stimulated by fear of collapse or redundancy and comes too late but the process of change from regarding the institution one works for as an authority on high outwith its employees the sole decision maker and to regarding it as right and proper for employees collectively to monitor the aims and social adequacy of the social organism that they as individuals add up to, is a very radical and significant shift in outlook We need to study and study hard how this new factor in the social decision-making process could operate — and clearly technological design would be one of the most important fields to be affected

'The answer is to have a society based on human values other than buying and selling'

Enid Mumford's Participative Systems Design could be one useful starting point Another that I personally regard as very significant is the Lucas Aerospace Combine Shop Stewards Committee's Corporate Plan They have been trying hard to involve academic and research establishments in thinking through the wider social implications of their proposals and it is a serious criticism — and a symptom of advanced sclerosis in the social thought cells of our 'institutions of learning (1) that the support they have received has been negligible This is not the place to go into a full account of the Lucas workers plans — but one highly significant aspect of what they are doing is that they are defending their jobs by themselves specifying the social uses to which their collective resources might be put They have, as it were, monitored the future directions in which their organisation is moving Where the existing market and profit motivations appear to be generating useful products and securing employment the existing system may be left to operate as at present but where the market fails and redundancies threaten the possibility of producing new socially useful products is indicated and costed socially – that is it is demonstrated that socially useful deployment of resources involves much less social cost than allowing resources to become idle and more men and women to become unemployed

A very interesting aspect of this undertaking has been the new inventiveness in design that is generated when social use becomes the direct objective of the designer This I believe is in fact the only way to ensure that the immense new potential of computer technology is used to social advantage Human beings (who are the elements which as collectivities become our social organisms) can consciously assess possibilities both of using technical knowledge to create socially useful things and also of doing so in ways that are rewarding to the producers themselves, the producers themselves must be the starting point from which to monitor the internal as well as the external benefits of new technologies

A new structure of economic relations and motivations that such planning to use resources for socially useful purposes suggests is one that in the first instance, must exist alongside market-motivated production stepping in where the existing structure fails Such direct adaptation of resources to social needs under the control of the individual human beings who collectively constitute 'a factory, a hospital an office' or any other social organism calls into being disciplines and motivations that can replace those of money and profitability and can pay respect to human values in determining both what products to make and how to make them Such direct adaptation of resources to socially useful purposes is every bit as feasible as was the adaptation of resources to our wartime needs that we successfully undertook here during the Second World War

We need to make scope for new ways of using resources *wherever people themselves so want to do* By its very nature such new structuring of activities requires grassroots motivations and must be limited to fields where this can freely grow Change in such directions also requires will and courage to think through how the potential of the information revolution can be adapted to help democratisation rather than centralisation of decision making The present universal yardsticks of making and having money are not adequate to our new scientific and technical potentials We need to learn how to look directly at the feasibility of socially useful projects and see that financial mechanisms are subordinated to these ends There are complexities you say sure — but should we not have the courage to tackle them as directly as we tackled our wartime needs in 1939-45 We need to escape from enslavement to the mystifications of finance Money and the market serve however clumsily to disseminate economic information is not an information revolution exactly what we need to remedy its defects? (2) ■

• *Write with your viewpoint to the Letters page*

Notes (1) The social function of learning is discussed more fully in "Science and Social Action (Allison and Busby 1978)

(2) This case is argued in Computers and Socialism (Spokesman Books 1973)

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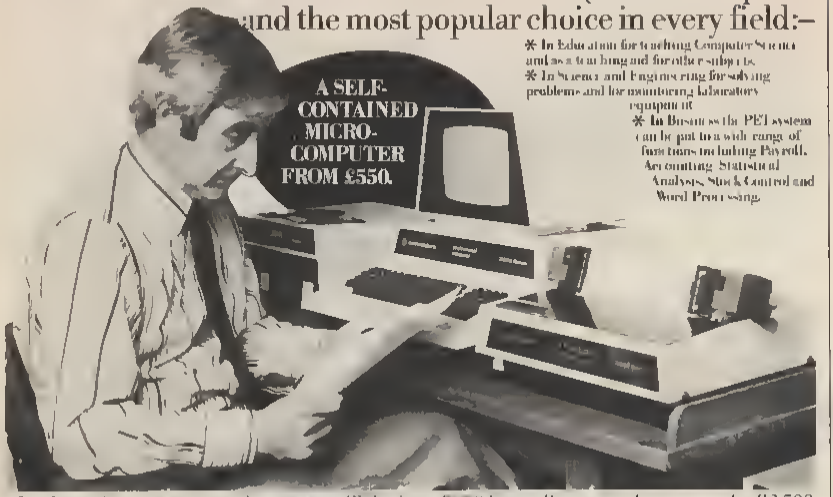

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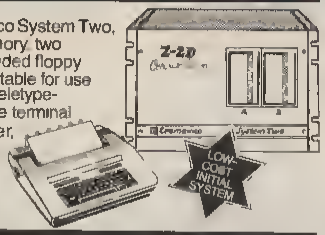

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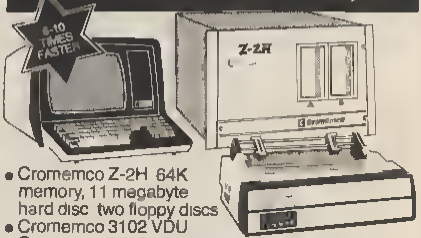

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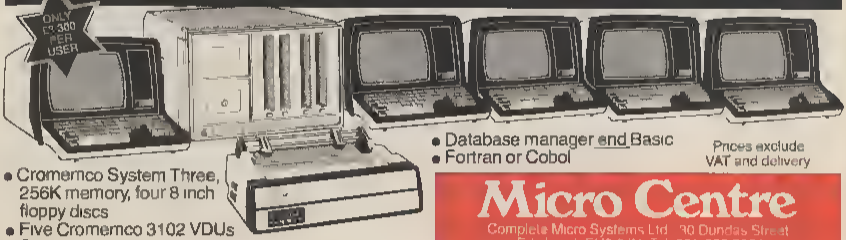

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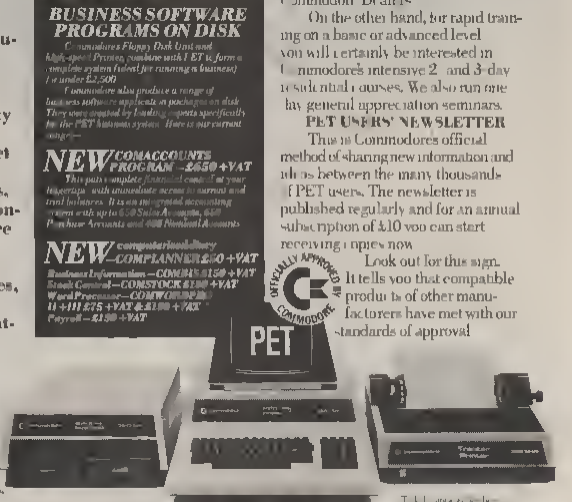

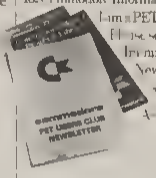

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SHOW BUSINESS

There are two stories that I want to tell – two strands that meet somewhere

Part A

I always wanted to be a doctor when I was young a medical doctor, later a Ph D At least you could push to the front of cinema and chip shop queues – let me through I m a doctor!

My parents met each other in the war, when they were working as nurses at Newmarket General Hospital and although neither continued there I was brought up in an atmosphere tinged with slightly fusty medical reference points like gentian violet and ether

My mother always swore she could tell which of the patients (nearly all soldiers) had been Boy Scouts – they didn t groan so loudly I think she still has this obsession with juvenile officer material though she s slyly learned not to trot it out as she used to I was a dismal Cub and Scout It all seemed so silly plus I couldn t do anything properly

So I always wanted to be a doctor at first because I thought that hospital life was inevitably, melodorously, alluring, then just because I aimed to compensate for all the knots I couldn t tie and stupid flags I couldn t remember by gaining a Ph D

Anyway my dream might be coming true I m going to pretend Professor!

Part B

This year I have been involved in three computer shows Two are still being planned, one recently opened

The Challenge of the Chip exhibition at London s Science Museum was opened on February 26th by a Norman St John-Stevas substitute The original had to keep another appointment which turned out to be in court where his client was acquitted (of an illegal (I think) something) no doubt due to the powers St John-Stevas was later quoted as having offered to the Magistrate in the sky Faced with the remarks of the Junior Education Minister Neil MacFarlane (This Government thinks microprocessors are very important) I got fairly drunk I ve never seen so much wine so many prawns at a state-owned exhibition the Arts Council make you buy your own drinks!

It was thus quite frightening to see the exhibit that I d made a graphics program running on an ITT 2020 flicking between monochrome and what passes for colour However others informed that it was indeed performing this trick There s a micro-based organ you can have a go on and that was nice It felt like playing honky tonk piano in a pub

I ve got more to do with two other events still in the pipeline I am one of a group co-organising an extravaganza at the Institute of Contemporary Arts and I m getting together a show of Canadian artists who use computers that will be on in London and maybe Paris next year

There are differences between these events and I think that they are worth mentioning because they reflect different attitudes towards computers and what they can do

The Science Museum show for all its welcome interactive features is more readily characterised by the photographs of a washing machine laid out for the press at the opening (and it is true that a week later at least five exhibits were not working)

The message or near-rhetorical question – seems to be How will the technology affect us? What new things are coming along to alter our lives – and isn t technology well you know a *bit* wonderful?

We are shown the assembly of chips, but not the reasons why this can be done so cheaply Look at the chips in your machine – where do they come from? Malaysia? South Korea? El Salvador? Who makes them? How much do they get paid?

The booklet (£1 25) that goes with the show makes passing reference to unemployment but asserts that microtechnology will create jobs Sure For whom though? For the people out of work in steel towns or on car assembly lines? For labourers? I shouldn t think so

A fine show in some respects it nonetheless seems to pay little attention to the context within which all the gee whiz technology happens The washing machine the sewing machine, the brain machine and the killing machine are there side by side What s it all going to do for us?

Sew for us think for us wash us and kill us presumably

The ICA show should have been open months ago – we ve been having design and money problems and after a number of postponements January 1981 now seems likely

It is to be called Consequences and will deal as the title suggests with issues raised by the arrival of cheap information technology in our society the emergence of the information environment I can t speak for the other organisers but I see it as a kind of think tank that s fun-to-be in There ll be loads of interactive computing going on with parts of the show reaching to peoples reactions to it Ideas will be presented using all aspects of the technologies itself along with older media computers theatre video talks control

systems viewdata film, happenings information processing, discussions and performance I hope the show will be organic changing and responding to the people at it

It could be miles better that the Challenge of the Chip or much worse We could demystify provoke and educate whilst entertaining teaching and changing Or we could be tooling around with micro based nonsenses Obviously I believe it'll be nearer the former than the latter But how to make it so? What would you do?

I take as a starting point the belief that most people (I don't know whether you could say most people who go to events at the ICA but that's a further complication) – most people are mystified about the forthcoming information environment including computing in general

I don't mean that people habitually go around banging their heads on table-tops crying 'My God I wish I understood about computers' – though doubtless some do (I suppose that's better than banging your head against a computer saying 'My God I wish I understood about people') No by 'mystified' I mean that many of us have a mystery somehow thrust upon us It is in certain peoples interests to mystify us

Some may think that computers can do anything and will change the world for the ever-so much-better tomorrow Others may suppose that all such technology is dangerous stupid and should be ignored when it will go away Both attitudes are

Discourse

myth-takings both I suggest would be [illegible] Again though how How would you do it?

I try to do it by making reference to our common awareness of *other* ways in which we experience the world and other people If you can see and learn something about what say Russian socialism or Western democracy do to people or if you have opinions about the market the buying and selling of commodities including computers and information then of course you can fit new things into that or those schema

'Their faces couched in amethyst, predictions finely set'

After all, people aren't daft. Many more than the Left often realises and than the Right often deludes itself are in their day-to-day practice engaged in *finding out and acting upon the world* and know where it's at Just think – despite the numbers who read proudly Tory-oriented papers such as the Mail Telegraph Express, Sun, etc about half the voters at each election vote Labour! Incredible!

But most of the time it's grey faces on television pundits and politicians who'll tell it like it never ever is Their faces couched in amethyst predictions finely set their slightest move a gross insinuation, their musk rat micro-eyes assume the stare in yours fixed on their carcinogenic smiles and meditations Poor, poor us We've got to do it to try it, to learn about it and teach it and all despite the blue meanies Thank goodness we all know we can

The last thing – the Canadian show – it's got to be computers and it's got to be art it's got to be Canadian because it's going to be in the Canada House Gallery in Trafalgar Square and it had better be glorious and not make anyone think that just ordinary living in the *world* will do oh no mate Got to live up to this rhetoric here That's why I wrote it And this guy a Canadian professor in art and design (who's got his *own PDP 11 computer* bloody hell) came over, and we talked and got off on each other's views about computing and art so well that we instantly arranged to do a job-swap for a few months sometime in the next year

I'll go to Canada and be a pretend Professor, and have his house dog and car He'll come here and have well not much actually Still A Professor eh!

(A friend told me I'd got to finish on a positive note this month because I usually end up denigrating myself or being self effacing Sorry Sorry) ■

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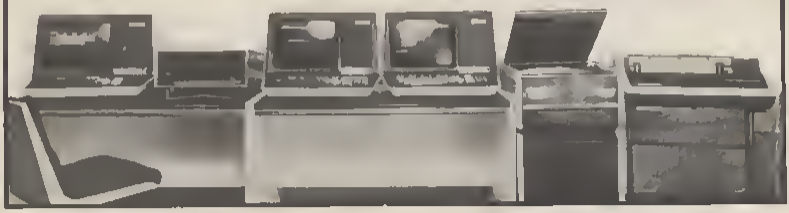

TECHNOLOGY MARCHES ON

BUT WHERE?

Something is afoot in the Lilliputian world of microprocessors something that is at one and the same time exciting for potential users of the beasties and incredibly confusing

That something is called a 32-bit micro and with its advent starts the time for pondering whether it will become the boon or bane of systems manufacturers and users Will a processor that powerful enhance the capabilities that can be offered by systems manufacturers to micro running a washing machine It might just happen

These questions have been prompted by two events that came to light during the early part of March They made the news more or less simultaneously The more definite of the two was that a Hong Kong based company called Comptec had commissioned Motorola to produce a 32-bit version of its recently introduced 16-bit processor, the MC68000 The second was confirmation by Intel of a rumour that it had a 32-bit device at an advanced stage of development. Known within the company by the number 8800 it had been a rumoured development for some time though the earliest hints of the part had suggested that it would be an entirely new 16-bit processor designed to supersede the then only recently introduced 8086 16-bit part

The Comptec development is particularly significant for two reasons

The first is that the *internal architecture* of the Motorola part makes such a design change possible The second and perhaps more important is that engineers and managers at Motorola had hoped that nobody would actually want to carry out such an endeavour for some time yet

Taking the second reason first Motorola has been quietly anti any attempt to alter the design of the 68000 processor, because they have enough problems producing the part as it stands, without having to go through a revised design sequence production sampling and proving and all the rest of the problems attached to producing a new semiconductor part The existing design and architecture of the 68000 is reckoned to be amongst the most elegant and most complex ever realised Such opinions have come not only from Motorola engineers, but also from senior staff at rivals Intel

But the Intel engineers point out that, as a production part the 68000 looks dubious Intel claims that its own production process is the most advanced in the world, and *they* doubt that they could actually manufacture the 68000 Though Motorola disputes this suggestion there has been a tacit admission by senior Motorola people that they are only producing a single good chip from several wafers run through the production process Until the yield of good chips increases dramatically the company does not really want to become involved with producing alternative variants

The other reason for the significance of the Comptec move is that the 68000 s architecture includes a large array of 32 bit *internal* registers even though it is a 16-bit part In addition, the instruction set is not hardwired into the design of the circuit as in other processors, but is held as firmware in an on-board programmable logic array Therefore, by changing the design of the array the instruction set and even the word length can be altered

As a specialist in products based on Digital Equipment hardware, Comptec plans to use the part in systems compatible with the DEC minicomputer line It will be designed for programming in high level languages only with Cobol Fortran and Basic compilers operating through an intermediate language akin to PL/1

What is important about these moves from the user s point of view is that the semiconductor industry has been making strong noises against such developments Ironically among the most vociferous has been Intel a company which while being a

leader (if not [illegible] technology, has already [illegible] tional business as [illegible] This has given the company the opportunity to see the computer business from the other side and [illegible] statements of senior personnel in Intel they have not been altogether [illegible] the view

Perhaps the most notable statements on the subject have come from William Davidow, vice president of Intel's Systems Division. Speaking at a conference in Washington last year, he suggested that it was time to call a halt to the development of new processors and sub systems so as to allow users time to catch up and understand how to use what was already available.

The reason for this was nothing to do with hardware certainly, the theoretical advancements in hardware capabilities possible with bigger and better processors and sub systems could easily be the joy of any systems designer's heart. No, the problem lay with the old favourite, software.

The cost of developing software for micro-based systems has increased alarmingly as their application has spread. In the early days, when the number of applications was low, and the actual requirements of the application were relatively small, it was possible for one or two people to program the software for a system, in assembly language with not too much trouble or cost.

Viewpoint

Today the number of applications has grown enormously, yet the number of people available to provide the programming skill has not expanded to match, certainly if the programming is to be in assembly language. This has meant that high level languages have had to be made available. Yet to make them available costs someone a great deal of money, and that someone at the end of the day is always the user. However though high level languages have made programming easier they have not made it easy enough for the majority of potential users to produce the needed applications packages. Again someone has to provide them and the user has to pay.

'The cost of developing software for micro-based systems has increased alarmingly'

As the level of intrinsic knowledge of computers and software goes down amongst users, which it must do as the number of applications and users expands so the cost of providing that software from some other source goes up.

Ironically, just as the [illegible] manufacturers and software [illegible] producers have started coming to terms with the complexities, capabilities and possibilities of 8 bit microprocessors, the semiconductor industry has come up with 16-bit devices. These all greatly enhance the potential capabilities of systems, and open doors to the production of new products and the exploitation of new applications areas. But at the same time new software tricks have to be learned, and learned at a cost, and we all know who pays for that. This was the essence of Davidow's message — technological advance for its own sake is not always to the total advantage of the customer.

Despite this, Intel is in there among the leaders again, with talk of a 32-bit processor being produced before users have even started to truly comprehend the possibilities and problems of 16-bit parts.

One final thought however. There is one school of thought which suggests that a 32-bit micro could well become the ultimate sledge hammer to crack all nuts. It would have sufficient power to run such future developments for microcomputers as natural language programming, which in turn would help make the applications market large enough to create the ultimate general purpose device. Imagine a 32-bit micro running a washing machine. It might just happen. ■

Martin Banks has recently been appointed editor of Microcomputer Analysis, *a Macintosh publication.*

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GIANTS STEP BACKWARD?

For the first time in the computer industry, the personal [illegible] industry [illegible]

IBM, the world's largest computer vendor, and Hewlett-Packard, the world's second-largest minicomputer manufacturer, recently announced their personal-sized computers, the 5120 and the HP 85. Although the importance of these two computers is undisputable, the significance of their new computers is unclear. The machines appear to be high-quality products that will grow into versatile systems, but it is possible that IBM and HP will find little interest and therefore sales somewhat disappointing.

The 5120 and the HP 85 are more expensive than comparable offerings from other vendors. For small businesses, home users and hobbyists, price-performance is paramount. But larger businesses, along with scientific establishments, are often willing to spend more for a reliable product manufactured by a big-name company with proven service capability. For wealthy buyers, a computer from either IBM or HP, by virtue of its maker's reputation, is more desirable than a similar product from a less respected vendor.

In IBM's case, this is especially true among users in the business world. There, large IBM machines are standard; they have made the company's name synonymous with computers in general. But IBM's success in the personal computer market has not been equally impressive, as evidenced by the disappointing sales of the 5100 and the 5110. Some computer experts now believe the 5120 will not do much to improve that situation.

The 5120 is a desk-top system and is IBM's lowest-priced computer to date. It is designed for business applications; current software packages handle inventory, billing, payroll, accounts payable and receivable and general ledger accounting. It uses a new diskette technology. IBM has not said much about its diskettes, but attributes the machine's low price (for IBM) to the technology.

According to Alan Kaplan, senior editor of *Electronic Business* magazine and a follower of the computer market, the 5120 is simply a slightly improved 5110. "I keep looking to IBM for revolution," he says, "but all I see is very slow evolution."

"One of these days," Kaplan predicts, "IBM will surprise us all with something new and radically different." But for now, he observes, the company is struggling to overcome what he calls its "enormous inertia."

According to Sanford J. Garrett, who watches the computer industry as a vice president of Wall Street brokerage firm Paine, Webber, Mitchell, Hutchins, the 5120's problem is not its technology, but its price. "At a lower price," Garrett says, "the 5120 would be a winner. IBM is feeling out the market – if it looks good, the company will later price the machine more aggressively."

The 5120 ranges in price from $9,340 to $23,990, depending on configuration. For example, a system including 32K bytes of main memory, a 120-character per second matrix printer, BASIC and two diskette drives with storage capacity of 2.4 megabytes would cost $13,375. By way of comparison, a similarly configured 5110 would cost $16,000.

Garrett says that the 5120's price represents an IBM marketing strategy. "The

Letter from America

company is charging a high price in order to fund the machine's development he explains In the meantime he adds its outrageous pricing of the 5120 will probably prevent any real sales success

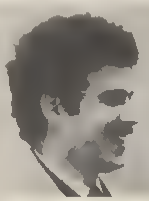
Because the 5120 is IBM's economy machine it is being sold in the company's Business Computer Centers IBM says the price of the 5120 does not include enough profit to support direct selling at customers offices

Hewlett-Packard's new personal computer is also being sold in retail stores – but these outlets are independently owned The same stores may also carry the company's line of desktop and pocket calculators

The HP-85 is the company's first personal computer It features 16K bytes of read-write memory a five inch black-and-white CRT and a four-inch printer capable of two 32-character lines per second All the components are housed in one box Total weight is about twenty pounds

According to Carmen West, the HP-85 product manager at the company's Corvallis, Oregon office HP picks retailers it believes can offer a high level of customer service and support But some dealers complain that the company's pricing on the 85 is unfair Although none of the retailers HP has approached have turned down its offer to sell the machine, the mark-up on the computer does not please many of them Because their profit margin is only about 25 per cent there is not much room for complementary support which customers sometimes expect

So far HP has not offered much in the way of software for the 85 Nor has it released a good range of peripherals Thus has both retailers and potential users worned Although the company says a wealth of software is on the way programming is now as one New York retailer says a do-it-yourself job Similarly plans to permit the HP-85 to use IEEE 488 or RS 232 peripherals are just that for now



Peter Kraus

The 85 is primarily designed for scientific, technical and financial professionals These are not people who want to spend a great deal of time writing their own programs Instead they will ask retailers for software The retailers in turn do not have much programming ability

By comparison with other personal computers the HP 85 is not cheap although it is much less expensive than the more powerful IBM 5120 It currently lists for $3,250, other personal computers cost $1,000 to $2 000 But despite the high price of the 85 there are many HP fans who will buy the machine They are a group that one computer retailer describes as customers who buy anything with the HP name on it " They have bought HP calculators despite the availability of lower-priced units from Texas Instruments and others they are willing to pay more money for what they perceive as a higher quality product

In addition to questions about the 85's software availability and price, some computer experts wonder whether the computer represents a real advance

A computer scientist working in one of RCA's laboratories says that until the HP-85 can be interfaced it is simply a "pocket calculator that's too big to fit in your pocket."

He is not alone Dale Kutnick of consultants Yankee Group says "The 85 may be impressive today – but it won't be for long In a year or two HP is going to get clobbered by the Japanese who will have better machines for the same price

Kutnick also thinks that HP is showing "shortsightedness in its business strategy HP is chasing a market that is unlikely to show big growth he explains referring to accountants stock brokers engineers and scientists

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[illegible] and [illegible]

[illegible] and the 380Z's [illegible] minimum quantity reduces the chances of this happening.

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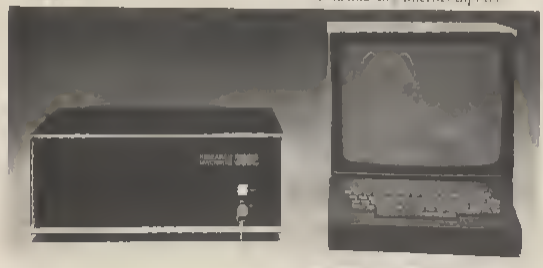

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Remember that professionals writing packages for your cassette system will themselves often use a disk 380Z and the power of their tools will influence what they produce.

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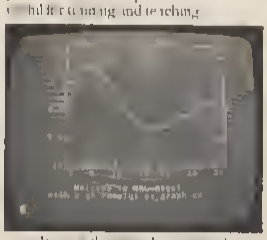

It is worth remembering that [illegible] our optional scientific high resolution graphics has any limiting effect on your memory usage and in both you can

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COMPUTER-GENERATED EVIDENCE

Untouched by human hand — and therefore not guilty

The recent Court of Appeal ban on computer-generated evidence has led to calls for new legislation in the face of increasing computer-related crime

The case of Regina v Pettigrew in the Court of Appeals last January has served to highlight a gap in the Criminal Evidence Act 1965 which requires that any document submitted as evidence in a criminal trial is a record relating to any trade or business from information supplied by persons who have or may reasonably be supposed to have personal knowledge of the matters dealt with therein

Pettigrew was convicted of burglary in his original trial, and the weight of the evidence against him had rested on a Bank of England computer print-out of the serial numbers on new £5 notes It was suggested that three new £5 notes found in Pettigrew's possession could have come from a bundle of £650 in £5 notes which formed part of the stolen property and could be traced back through a Trustee Savings Bank, to the print-out issued by the Bank of England

Pettigrew's counsel Keith McHale had at that time objected to the admission of the print-out as evidence on the grounds that the document was not a record of any trade or business but the judge had not acceded to the submission and ruled the evidence admissible So in the appeal, McHale, while not abandoning this point, added the objection that the information recorded in the print-out was not supplied by a person who had personal knowledge of the matters dealt with in the document

As a result of this submission the appeal was upheld, because in this case the print-out was generated by a machine into which the newly printed £5 notes were fed in bundles by an operator who noted onto a card only the first serial number of each bundle

The machine noted the serial numbers of the first and last notes in the bundle and automatically rejected any notes which were defective while also noting their serial numbers

Lord Justice Bridge who gave the judgment upholding Pettigrew's appeal said that although the point was highly technical the numbers of the notes which were regarded as having been rejected could never be said to be in the personal knowledge of anybody but were recorded purely by the operation of the machine

The judgment has led to a great deal of concern in the computing industry and among lawyers as to whether the criminal evidence laws of this country are able to cover computer related crimes

Paul Sieghart, barrister and former software director having studied the judgment as reported in the press said ' Parliament must now introduce a new clause to cover this eventuality

Alistair Kelman a barrister who has made a special study of legal problems relating to computing agreed that changes to the law should be made The increasing use of and dependence upon passive security systems by banks, defence installations and government departments require immediate alteration to the law of criminal evidence " he said

He went on to explain his concern over the judgment "Every major computer installation has an automatic security system which logs user number password access time files looked at and records altered It now appears to be the case that a criminally minded computer expert used a remote access terminal over a telephone line to alter records on a computer such as records of debts, the log of access time and records altered could not be used in evidence in any criminal prosecution against him

Concern about the judgment has also been expressed among auditors in the UK who feel that companies may have to reorganise their computerised auditing and accounts systems

Graeme Ward president of the Institute of Internal Auditors has pointed out that although computer related crimes are on the increase successful prosecutions are virtually non existent

Ward said "It has been the official policy of the Institute of Internal Auditors for some time to get the law changed in this area We have approached the Lord Chancellor's office the police the Data Protection Committee and various MPs though the recent case in the Court of Appeals did serve to stress the need for changes

Andrew Warren computer audit partner with accountants Deloitte Haskins and Sells was more concerned with the practical implications for computer systems of the judgment

From the reports I have seen the judgment seems to go against what is practical for computer auditing systems It would be quite impractical for a lot of large organisations in this country who deal in large computer transactions and it could cause a lot more work to be done in data processing departments, which could in turn be very costly," he said

The question of possible reorganisation of computerised auditing and accounting systems was echoed by John Butcher Conservative MP for South West Coventry and vice chairman of the Commons Information Technology Committee who commented "Could it be said in the case of optical character recognition users for example that any particular clerk or operator has personal knowledge of each record input which will later appear, perhaps in a different format in a print-out?

"I sincerely hope the ruling in the Court of Appeals does not have this implication for if it does many companies will have to completely reorganise their computerised auditing and accounting procedures perhaps at great expense"

Graeme Ward, who feels that the prosecution in the Appeals case was handled very badly remains concerned with the fundamental question of how the law operates in such cases He believes that under such circumstances an independent expert should be called as a witness to the reliability and controls of any system producing data that might be used in evidence

His suggestions follow the general legal pattern for such cases in the United States where the onus for establishing the admissibility of evidence rests with the prosecution lawyers

Edward McDermott, who practises in the law firm of Hogan and Hartson in Washington DC explained "In criminal trials a lot would depend on the position

Evidence

taken by counsel for the defence It he objected the obligation would then be on the prosecution to show its relevance and prove the credibility of the data to the court So the prosecution could call a computer technician to testify as to how the machine worked and the reliability of the system It would then be up to the court to decide whether the data was credible and could be used in evidence"

In the UK however the 1965 Criminal Evidence Act is more specific as to the admissibility of evidence and any change to the law would necessitate the introduction of safeguards

'The judgment has led to a great deal of concern'

Paul Sieghart while calling for changes to the law noted the need for such safeguards

In 1965 the clause allowing documents to be admissible in evidence was introduced and of course the safeguard regarding personal knowledge came with it If we are to have new laws to cover automatically generated output then we must also have new safeguards

Sieghart's sentiments were echoed by Professor Brian Niblett professor of Computer Science at University College, Swansea and a leading authority in the field of computers and law who said "It would not be difficult to make an amendment to the 1965 Act but we must ask ourselves if we really want an amendment

Of course, he added even allowing for the fact that the evidence might be admitted it would then be necessary to assess its weight in relation to other evidence in the case"

Niblett added that a clause regarding personal knowledge was generally regarded as a liberal provision in the 1965 Act and he was concerned that unless any amendment was phrased very carefully possibly spurious content in computer generated output could form part of the evidence in a criminal prosecution possibly leading to a conviction

On a more optimistic note, however he added "Judges do not like machines making judgments"

The doctrine of precedent in the UK, which allows for case law to be used in a defence will doubtless be followed with reference to the appeal of Pettigrew, and the implications for successful prosecution in cases of computer related crime where one expert recently put the average take from a single computer theft at £250,000 could indeed be far reaching unless some change to the law is made soon ■

* *Lynd Church is a journalist with the weekly Computing*

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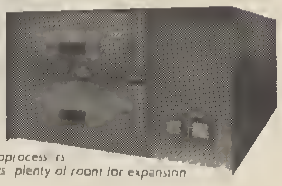

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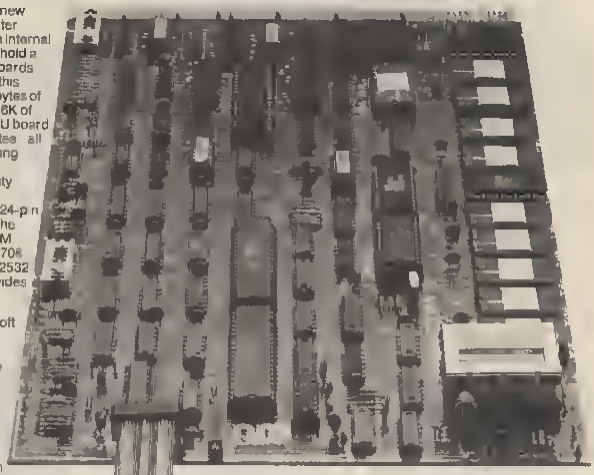

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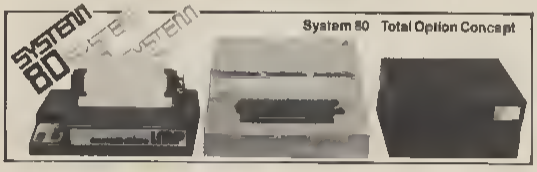
Nascom-2 specification in brief

CPU Z80A **Clock rate** Switch selectable 2/4 MHz
Memory 10K bytes of ROM 2K for NAS SYS 1 *N M crosoft BASIC
Keyboard 57-key solid state full alphanumeric QWERTY layout Laser mainframe quality keyboard with cursor control keys
On board interfaces Domest c TV at 50Hz 625 lines (adaptable to 60Hz/525 l nes) displaying 16 l nes of 48 characters
Kansas C ty type audio cassette (300/1200 baud) or Teletype RS232 for printer 16 free programmable P IO lines.
Graphics 2K bytes of ROM 128 graphics characters 128 character ASCII with full upper and lower case Alphanumerics



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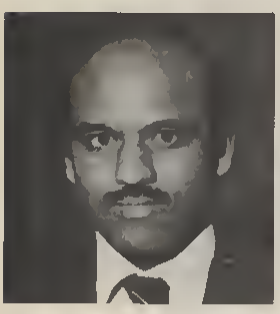
POLICY DECISIONS AND THE NEW TECHNOLOGY



This [illegible] field [illegible] them an [illegible] usage in the [illegible] requirement [illegible]

How will micros affect the educational aspect of business studies?

The Micro Revolution

The aim of this short article is to help the reader who is involved for the first time with micros/word processor projects for learning and teaching in the further education sector

I hope to assist the reader in considering the following questions

- 1 In what ways will the micros/word processors broaden the horizon of students and help their present prospective employers?
- 2 Why should micro application be taught in business management and office skills courses?
- 3 Is it socio-economically the responsibility of the Business and Management Studies department in a F E college to encourage the use of this new technology in British working life?
- 4 Who should be responsible for the development of the Micro Computer Unit within a department?

The article implicitly answers

The microprocessor (microcomputer) revolution is happening so quickly that computer power, which until the last two years was under the control of sophisticated data processing departments with dozens of highly trained technical staff is now available to teachers in business and management studies at reasonable cost

All computers have a processor sometimes called a Central Processing Unit CPU It is the brain of the computer Microcomputers are constructed from microprocessors in which the complex functions of control and information handling are put onto silicon chips Silicon one of the 100 or so elements of which the Universe is composed is also one of the most abundant

A word processor is something like a semi-automatic typewriter A secretary using it can greatly increase her output if she is typing letters or documents with standard passages Word processors linked up to video display units and information retrieval centres, can form the centrepiece of new office computer systems Word processors can communicate with each other using telephone lines A letter typed in Loughton college can thus be received quickly in the County Education Department Chelmsford

Computers do not work by themselves They have to be programmed The programming comes under the term software which includes not only the programs written by the staff for their own use but also other programs produced commercially These programs are known as packages and they are usually fully documented so that the prospective users can make use of them freely

People of different nationalities speak different languages, and in the same way there are various computer programming languages The most common language used in programming microprocessors is known as BASIC (Beginners All-purpose Symbolic Instruction Code)

The price range for the hardware (microprocessors) is £180–£12000 In addition to this the software is required, which may be bought or developed internally

Departmental Policy

Since the advent of electronic data processing, most F E colleges have installed at least the time sharing computer system for the element of computers data processing in business studies courses It means sharing someone else's computer via GPO's telephone lines Indeed it is being discovered that the microcomputer has some substantial advantages over the admittedly more powerful time shared systems still being used in F E colleges For example in any educational environment a group of micros will give more training hours than the same number of terminals in a time shared system

Access to the time shared system in most colleges is for computer studies tutors and their students However this is no longer necessary as microprocessors are not only available at a fraction of the cost and size of the main frame computer but their use is also more economical than linking into someone else's computer

Microcomputers are portable They can be taken from one place of work to another even taken to industry for in plant training courses

The application of this new technology has already affected teaching methods learning resources and career developments in the U S A Japan and other parts of the world and has just begun to influence the British education and training systems In contrast the French have decided to put a microcomputer into every school

Many tutors and heads of business and management studies departments are taking a completely new look at their teaching methodologies and learning resources in order to

- **1) know the ways which will broaden the horizons of tutors and help their students**
- **2) recognise the educational, social psychological and economic implications of introducing microprocessors and related hardware and software to all members of their departments.**
- **3) develop the departmental policy for the application of microprocessors for teaching and learning**
- **4) evaluate some of the available microprocessors word processors and software packages with a view to installing the chosen items**

Installing a new system is always difficult and it is certainly not easy dealing with microprocessors It is therefore hoped that this short article will help

readers to gain the support of all those whose decisions can affect –

- a) the aspirations expectations and roles of the tutors and the head of departments concerned,
- b) students learning and their future prospects in industry commerce and government
- c) the students present or prospective employers expectations from a technical college

Often the media reminds us that the micro revolution will create winners and losers The F E colleges should include themselves among the winners and accept micros as an additional teaching aid instead of a threat Tutors must train themselves in the use of micros in the interests of their students industry and society as a whole

Computer Aided Learning and Teaching

The following table is a sample of the teaching of various subjects teaching aids and students learning based on Learning by doing

Benefits

A head of department should recognise the benefits arising from computer aided learning and teaching Some of the benefits to tutors students and the industry are listed below

Implementation

- **Benefits to Tutors**
  a) Automatic aid for testing theories models and formulae prior to presenting these to students
  b) Speedy computation thus eliminating the factor we have not got much time let s consider a simple example
  c) Accurate results – lengthy and complex computation can be performed with the highest accuracy
  d) Psychological confidence – tutors gain confidence as their teaching material can be tested in advance

- **Benefits to Students**
  a) Programmed learning – students can use the system for remedial reading revision, problem solving and above all skill learning
  b) Motivation – through the literature on the use of microprocessors in teaching one can see a significant improvement in motivation at least in the case of some students
  c) Privacy – it can be a vital factor in learning especially in the case of mature students and older students (re training under the TOPS schemes)
  d) Confidence in training– Microcomputers are here to stay in the 80 s A training in the use of this new technology helps students in gaining some confidence in their training

- **Benefits to Industry**
  Higher productivity implies less employment for the same level of output It Britain can seize the opportunity provided by microprocessors new improved or cheaper goods and services will become available Most comments from industry and the trade unions recognise that the U K must adopt the new technology as quickly as her competitors– faster if possible This ambition cannot be fulfilled without the active involvement of the Business and Management Studies Departments in F E colleges Teachers of business and management education must create a learning environment in which students can acquire some knowledge skill and practical experience Colleges should lay a firm foundation in this new technology upon which business and management studies students can build their psychological confidence in the British industry and serve society to the best of their ability

Subject taught	*Teaching aids*	*Students learning*
*Economics	Microprocessor Softwars packages	Analysis of Economic Flows Stock Market Business and banking Strategy planning Formulation of policy and testing theories
*Office Administration	Word Processors Microprocessors Software packages	Office skills Information storage and retrieval Mail handling
*Accounting	Microprocessors Software packages Personal programs	Billing Payroll Ledger Accounts Management accounting Functions (Cash flow analysis) etc
*Statistics	Microprocessors Software packages Personal Programs	Statistical modelling of business performance Forecasting Correlation and regression analysis
*Business and Commercial Law	Microprocessors Software packages	Legislation storing and retrieval – interactive and remedial learning
*Business Geography	Microprocessors Software packages	Facts learning and maps generating
*English for Business	Microprocessors Software packages	Language learning – remedial
*Management	Microprocessors Software packages Personal programs	Simulation of business conditions for decision- making Project planning & control Factory planning & control Manpower planning Sales training (interactive interview appraisal ( ) Risk analysis Stock control and various operational management techniques

A word of warning

For the development of microprocessors word processors for teaching it is unprofessional to appoint someone who has not been trained in computer studies and has not at least taught this subject for three years at the appropriate levels It is strongly advised that the development work should not be handed to 'empire builders An appointment for this development work in F E college Business and Management Studies Departments should be at least at the senior level and the person appointed should possess –

- *H ND Degree in Computer Studies or
- *Membership of the Institute of Data Processing Management by examinations and
- *Three years of teaching experience

Hardware and software purchase installing the equipment, introducing non computer studies tutors and students to computer aided learning and developing some programs is still a skilled and technical job It should be entrusted to a specialist tutor ■

Saeed Sheikh M Sc Dip Org Ps Cert Ed AIDPM is a lecturer in the Department of Business & Management Studies Loughton College of Further Education Essex His responsibilities include designing and running post experience programmes in consultation with the organisations concerned As a Management Cybernetician he is actively involved in introducing Systems Thinking to managers administrators and tutors of management studies Currently he is running a series of conferences on the impact and applications of micros for Loughton College

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Still the biggest 6 in the country
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Bristol
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&
6

EDUCATIONAL DATA BASES

Mike Aston is the Deputy Head of the Advisory Unit for Computer Based Education St Albans Hertfordshire

We are told by those that know' that the Information Explosion is upon us and that 'information' will be the currency of the eighties The interesting thing about information is that unlike money if you give it away you still have it yourself to use as often as you like This phenomena may have an interesting effect on the nature of society in the future It is clear that without computers we would not be able to cope with the massive increase in the flow of information that we are experiencing today, let alone what we might be experiencing tomorrow It might be helpful to give you my interpretation of the links between education and information indicating what part the computer has to play

Computerised information retrieval in schools had its beginnings in a number of projects funded by the National Development Programme in Computer Assisted Learning (NDP CAL) — namely the Local History Classroom Project (1974 1977), the Local Information Services Project (1974/5) CAL in Upper School Geography Project (1976 1978) and CAL in Secondary School History (1976). Three of these were concerned with factual data bases and one with resources of a bibliographic nature Commercially ICL has had considerable success with their information retrieval package FIND The main thrust of development has been concerned largely with History (census data) and Geography (settlement data), but we are beginning to see data being collected for use in a range of subjects across the curriculum e g foods (Domestic Science) jobs (Careers) stars (Astronomy) and elements (Chemistry)

Resources for learning

In some of our universities students and lecturers have for some time had access to large bibliographic databases such as those controlled by the Lockheed Corporation in California USA Retrieval of abstracts from journals and other documents on a variety of subjects is achieved by using a simple command language which allows the user to match key words in the database Recently several institutions have started using a microcomputer for learning resource information retrieval in the classroom The limitation of a cassette based system has meant that most of the development has been on dual mini floppy disk based systems One(Grammar School Norfolk have devised JOEL — a simple multi-media resource retrieval system which allows analytical indexing by a process of featuring items The features are listed in fig 2 where the subject is History and the class is second year

An example of a search to find material relating to Henry II *and* Thomas Becket reveals 5 matched records (i e 4 off prints and a magazine all held in Room 19), (see

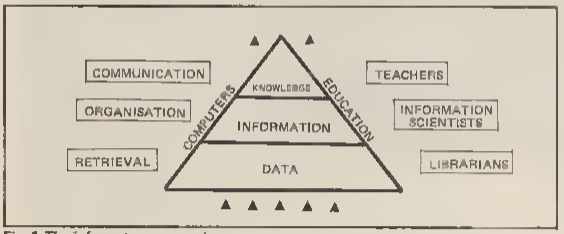


Fig. 1 *The information pyramid*

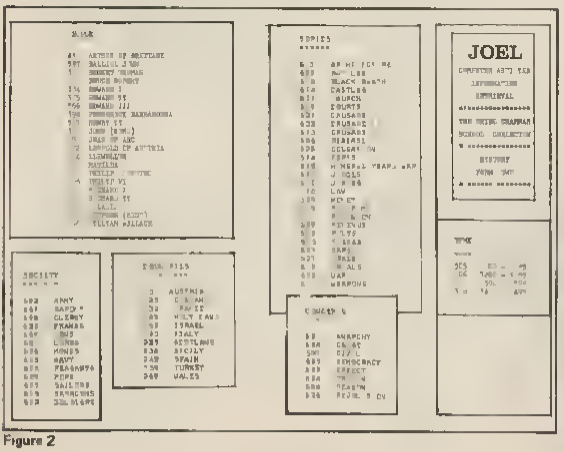


Figure 2

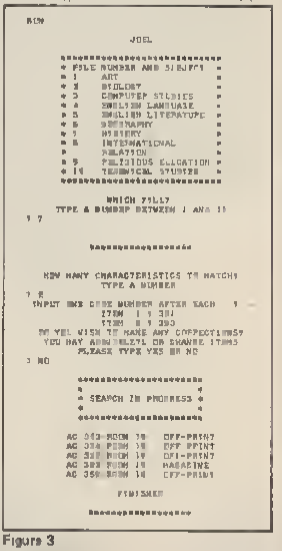


Figure 3

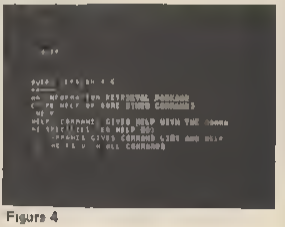


Figure 4

fig 3) They have deliberately kept the system simple, using number codes and avoiding Boolean operators to combine key codes

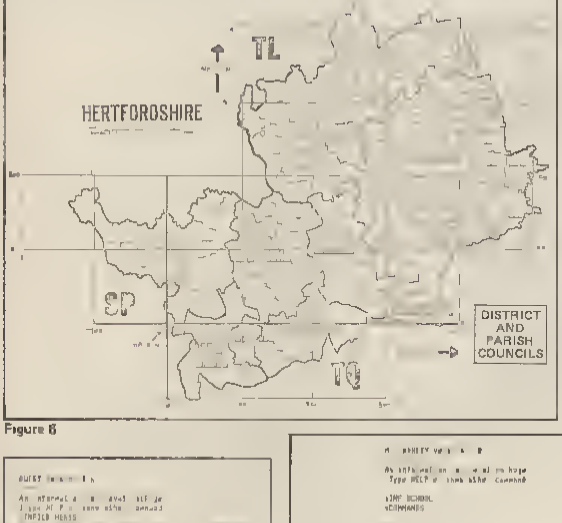


Figure 6

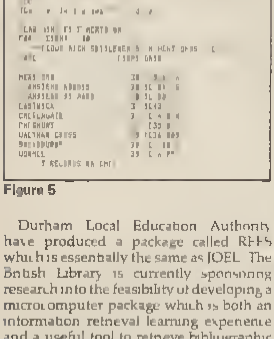


Figure 5

Durham Local Education Authority have produced a package called RFES which is essentially the same as JOEL The British Library is currently sponsoring research into the feasibility of developing a microcomputer package which is both an information retrieval learning experience and a useful tool to retrieve bibliographic resources available in schools and further education colleges

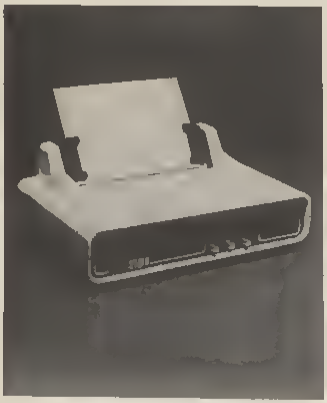
Hertfordshire LEA through the Advisory Unit for Computer Based Education and Hatfield Polytechnic has developed a powerful general purpose retrieval package entitled QUERY which runs on a large mainframe computer (See fig 4) Over 20 databases are available for searching and an example of a run to find possible flood risk settlements in Hertfordshire is given in fig 5 The database being searched has a total of 292 settlements and 16 facts about each settlement A map of Hertfordshire is appended for those readers unfamiliar with the geography of the area Recently a version of QUERY has been written for a dual mini floppy disk based microcomputer system Software has also been developed to allow the micro to download data from the mainframe system to be searched in local mode by micro QUERY An example of a run to find out what computer facilities there are in voluntary aided or controlled schools in the Watford division is given in fig 7 The database being used here contains information about all of the 119 secondary schools in Hertfordshire including what computer hardware is available and what courses are run

The Future

The most precious part of all that I have talked about so far is the data itself It is expensive in both time and people to collect, it is dynamic (i e changes with time) it is tedious to keep it up to date As computer memory gets cheaper and our know-how develops in the use of disc-based micro systems we should see quite large databases being made available in the classroom and in the home, together with an easy to-use package which can generate information and not just facts ■

Figure 7

LET'S TALK SENSIBLE PRICES



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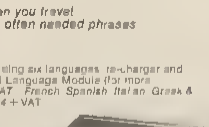

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EDUCATING THE MICRO FOR CLASSROOM USE

The ITMA project concentrates on investigating the micro as a teacher's aid. The full-time staff of the project team come from the College of St Mark & St John, Plymouth.

To follow up the general description of the ITMA (Investigations of Teaching with a Microcomputer as an Aid) project which appeared in *Computer Age* Issue 5, April, a series of extracts will be printed from the project's Newsletters. We start this month by reproducing the index to the first Newsletter, but one article has been selected to be printed in full. This article illustrates some of the project's considerations about the microcomputer itself.

ITMA Newsletter 1

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One of the aims of ITMA is to examine how the strengths of the machine can help to create an exciting and stimulating environment in which *people* play the most important role. Two assets of the microcomputer systems are its speed of response and its graphics capabilities. The project will seek to use these strengths and others that may be identified. (ITMA Discussion Paper 1 – October 1978)

A microcomputer system in the classroom can provide the teacher with many extra facilities very valuable in such areas as motivation and diagnosis, apart from acting as a tool to supply and analyse data. In order to fully appreciate this potential investigations and evaluations need to be undertaken to discover:

- a) The variety of facilities that the microcomputer system could provide
- b) To what extent, and in what ways (if any) these various facilities could be used to advantage in schools.

Before the advent of the microcomputer, most educational computer programs consisted of some form of written dialogue between the machine and the user (whether an individual pupil, a group or a whole class), perhaps interspersed with simple tables or graphs. Cheap microcomputers and VDUs enable the extension of this format to include more sophisticated dynamically changing graphics and even simple animations. Whilst these facilities offer an enormous potential to the teacher and pupils, it would be a pity not to investigate and exploit other strengths of the micro which could perhaps provide an even richer and more varied educational environment.

Without the need for additional sophisticated hardware or software, it is possible to *significantly* improve the responsiveness and usefulness of the machine, by using *simple* machine code routines.

A trivial but illustrative example is to get the computer to print the complete word YES in response to the user typing the single letter 'Y' and continue automatically. However this idea can be used to provide a much greater saving of time and effort, particularly with the usual 'non-typist' pupil (or teacher), by arranging for longer commonly required words or sentences to be generated by single key strokes. Together with the graphics capabilities this would allow lines, shapes or diagrams to be entered with single keys. A specific example is producing a large copy of the symbols being typed, perhaps for use with infants. The plotting facilities in the graphics would also allow this routine to be used to dynamically draw diagrams or shapes on the screen *without* knowledge of the co-ordinate system involved by using a block of arbitrarily chosen keys to move a point on the screen in different directions, with or without leaving a trail behind it. These last two ideas could be used not only as a quick and dynamic classroom aid, but also as routines to aid the non-computer specialist wishing to devise and develop material and examples for the computer.

There is yet further potential in this simple routine in that it can provide a *selective* input, so that invalid keys are ignored, thus considerably reducing the pressure on the user who might otherwise be somewhat intimidated by the machine. Also inherent in this last facility is a *diagnostic* aid for the teacher, as the computer could easily be programmed to record (for later display) the wrong keys pressed by the user (eg in a spelling program) whilst being invisible to them.

One other example of a machine code routine with great possibilities is one to introduce a time factor into the programs. Thus can be visible in that the users are motivated to react in a certain time before being informed that they are too late (the time involved being capable of variation according to the user's input, if necessary). Alternatively, it can be 'invisible', and could provide the teacher with data concerning the areas which users had difficulty in understanding. It could also be used to speed up or slow down the display of dynamic diagrams *at will* in any pro-

gram to suit the understanding and ability of the pupils involved

Whilst machine code routines such as in these examples, clearly have a potential in providing a flexible and varied educational environment, there are certain practical problems which need to be considered

Most schools using microcomputers at present use the language BASIC and as the machine code routine is effectively modifying the language there is a danger that a multitude of altered versions of BASIC will be produced (eg BASIC + User 1 BASIC + User 2 etc) This would result in the need for the programs to be run with the correct version of BASIC, and prevents program interchange even between users with similar machines unless the special BASICs are interchanged as well

To prevent this proliferation of BASICs happening, I feel that all BASIC programs which use special user routines should be self-contained with the machine instructions being 'poked' into stores by the program itself rather than being stored with the interpreter or compiler With most microcomputer BASICs this is possible the area of store for the routine being allocated by 'telling' the interpreter that there is less total memory available than usual In this way such programs will at least be able to run on any of the same model of computer with the standard BASIC Admittedly they would have to be modified to run on a different system but with simple routines of a few instructions, such as

Teachers

mentioned above this would not necessarily be much more difficult than transferring the normal (or from standard) BASIC instructions

Device control is a second area of potential The scope of educational activities could be greatly enhanced by the ability of the microcomputer to control simple devices such as tape recorder motors motors attached to items like pulleys or wheels and lights bells or buzzers The use of such computer controlled physical devices could provide a degree of variety and motivation not possible with the normal 2 dimensional computer output

'Their capabilities must be investigated to the full and then exploited'

The areas of potential outlined above are fairly easily implementable on the standard microcomputer systems currently used by schools, thus making the transfer of any material developed correspondingly feasible and practical As additional items of hardware and software become generally available to schools – detailed graphics floppy disc systems and voice input and output – we need investigations to discover and develop the ways in which they could be used to advantage

These, then are just a few starting points for the investigation of the microcomputer's capabilities and to a large extent it remains to be seen how much and in what ways these will be useful in schools

It must be accepted that a significant problem exists when developing educational software with practicing teachers they are very often unaware of the variety of ways in which the machine can be used and thus too often results in a certain staleness and repetitiveness of approach Microcomputers are powerful and versatile machines If they are to be used effectively in education their capabilities must be investigated to the full and then exploited to the best advantage of the teacher and pupils ■

Footnote

Some of the facilities described as needing machine code routines are now available in some versions of BASIC

Newsletters can be obtained from the Primary Science Centre, College of St Mark and St John, Derriford Road, Plymouth, PL6 8BH – at the cost of £1

The ITMA Project has an interactive program running at the SCIENCE MUSEUM 'Challenge of the Chip Exhibition' It illustrates some of the features of a microcomputer that a program designer can use, but it is not an educational program To illustrate the use of a microcomputer in the classroom the team are giving two lectures in the Science Museum on 29th April and the other on 2nd June Tickets can be obtained from the Education Office Science Museum, Exhibition Road, London SW7"

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COMPUTER LIGHTING FOR THE SMALL THEATRE

One of the most obvious differences between theatres in major cities and the provinces is the amount of money each has available to spend on equipment

In the area of stage lighting for example although sophisticated computer storage techniques to control theatre lighting have been available for some time the price of such systems can be expensive They cost between £20 000 and £30 000 and can only be used in the largest and most successful theatres

But now a company called BPS Control Systems Ltd of Lymm Cheshire, formed by two specialists to develop a versatile lighting — controller memory system, that meets the needs of the small provincial theatre can be installed at a cost of £6 000 to £8 000 quite a difference from the expensive equipment installed at the National Theatre on London s South Bank by Rank s Electric

The two founders of the new system are Barrie Stephens and Leo Bennett Barrie has worked as a design engineer at Ferranti and in the Computing Division of the Science Research Council s Daresbury Laboratory and, as a sideline as lighting and design engineer for the Garrick Theatre in Altrincham Cheshire Leo is the proprietor of Contel Ltd a small company specialising in the manufacture and marketing of stage-lighting equipment So both know the business and see that their designs for a lighting controller must fit in with equipment already installed in theatres, and also that it must be acceptable to and operable by the theatre s existing staff

Various techniques have been employed to enable operators to handle complex lighting sequences The most common employ several presets That is a lighting control board which is used to set up in advance a particular lighting combination By means of centralised controls the operator can bring into use one preset after another As soon as the preset has been used it can be reset manually for entirely new effects The speed with which one effect follows another dictates the artistic impressions brought about through changes in the location colour and intensity of the stage lighting

Requirements for increased speeds of operation has meant that even with the use of several presets it is difficult for an operator to accommodate the rapidly varying lighting sequences sometimes desired by an adventurous artistic designer

Several methods have been tried to provide easier lighting control Punched cards and paper tape have been among them, but none has proved entirely satisfactory Computer storage techniques lend themselves excellently to the requirements of a stage lighting memory system but are clearly very expensive What Barrie and Leo have done, however is set up a semiconductor memory which up to 128 different lighting scenes can be stored and transferred to a magnetic tape cassette for a permanent record

Thus allows the lighting sequence to be transferred from theatre to theatre In fact the magnetic tape controlling the lighting can go on tour with a travelling company The tape gives the system known as the BPS System 120 an unlimited cue storage capacity

The system consists of two units a standard 19 inch unit containing the memory boards, a power supply unit and interfacing equipment A small portable desk carries the operating controls cue indicators and such like The equipment is connected by way of the control lines to the dimmer cubicles and allows the theatre s existing control desk to be used normally if required

The portable desk is linked to the memory unit by a simple four-wire lead so that, provided the lead is long enough the control desk can be brought down into the auditorium to enable lighting adjustments to be made as the theatre patron would see it

The first step is setting up a lighting cue — that is the specifications for lighting levels for a particular scene — is to set the various levels on the potentiometer sliders on the manual control desk The portable desk is then used to key in cue at a time the various voltage settings which have been automatically converted to a digital format and displayed on the portable desk Each cue is given a particular location in the memory If only minor changes are needed from one cue to the next they can be made on the portable desk independently of the manual desk

The electronic circuits In the 19 inch rack interface with the existing theatre control desk by using time — division multiplexing In the read state the BPS unit scans each input channel from the manual theatre desk 50 times a second This information is converted to a five-bit digital code which can be operated by the control logic, and is put on to a common highway At the same time the data on the highway is read by a digital analogue converter so as to provide analogue voltages which are applied to the relevant dimmers

The common highway is also the means by which the contents of a chosen memory are applied to provide a particular lighting cue The control logic arranges for the selected memory contents to be read into a butter store which is connected to the common highway As previously, the digital to analogue conversion takes place to provide outputs which are applied to the dimmers

In order to store a particular scene in the main memory, data are transferred from the buffer store onto the memory by means of a memory highway In this way the 128 scenes previously mentioned can be stored If more than 128 are required, the contents of the main memory can be transferred to a magnetic tape cassette The transfer to the cassette must take place anyway before the power is removed as the semiconductor memory is changeable

The first unit developed by Barrie and Leo has already been installed at the Garrick in Altrincham for field trials The second unit is to be put in at the Theatre Y Win at Aberystwyth on the Welsh coast

At present there are more than 400 professional theatres in Britain Less than 10% of these having lighting controllers with memory systems To these can be added a developing number of civic centres and art complexes

The system Barrie and Leo are now offering the theatrical world holds out the prospect of performance to approach that of the most sophisticated modern lighting control at almost a sixth of the cost But, besides the great saving in cost, Barrie said perhaps one of its great advantages for the small theatre is that it can be fitted on to existing equipment

Once again it would seem science through the computer has come to the aid of art ■

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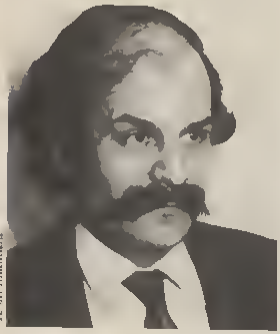


Yoshi Imamura

None of the devices mentioned so far in this series of articles can *store* information. When their inputs change, their outputs may change also.

It is often convenient to have devices which can remember their past. A latching relay is an electromechanical example. Latching relays stay on once they have been momentarily energized; they may be turned off only by removing their power source. Latching relays are thus good event recorders. A latching relay energized by a burglar passing through a light beam in a shop sounds an alarm that the burglar cannot stop simply by removing himself from the light beam. The relay notifies anyone who checks its output (an alarm) that a burglar has been present since the last time the relay was reset.

An electronic device with these properties is called a bistable multivibrator. More commonly it is known as a *flip-flop*. Figure 1 shows about the simplest kind of flip flop possible. This kind is known as a DC (or asynchronous) Set Reset Flip-Flop (or in brief: DC SR FF).

The terms *set* and *reset* refer to the two states the FF can attain.

When it is in the set state its Q output is high and its $\overline{Q}$ output is low, and when it is in the reset state Q output is low and its $\overline{Q}$ output is high.

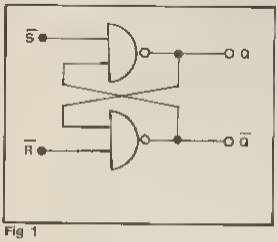


Fig 1

As long as both inputs ($\overline{S}$ and $\overline{R}$) are not low (ie not active) at the same time the FF's state is that of input that was low last, in other words: if the *last* input to go low was $\overline{S}$ and both inputs are now high the FF will be in the set state (Q high and $\overline{Q}$-low) until $\overline{R}$ will go low (and $\overline{S}$ stays high) in which case the FF will assume the reset state.

It is worth mentioning at this stage that if both inputs are simultaneously low then both outputs will be high, and this is an indeterminate state which the designer should be aware of. The reader should be able to verify all that was said in this last paragraph himself bearing in mind that a NAND gate gives a low output only if both its inputs are high.

In many applications the time (or moment) at which the FF is to be set or reset is important. The conditions for setting or resetting the FF should be present prior to that moment; when this moment comes the FF will set, reset or remain unchanged depending on the *prior* conditioning of the inputs. Thus "moment" is known as a strobe, trigger or clock, and to incorporate it in the design of the FF we need an extra input and two extra gates as in Fig. 2.

In this type of FF, called synchronous SR FF, the FF will set when the clock goes high and S is high and R is low, and it will reset when the clock goes high and S is low and R is high.

In some applications only one signal (D) is available, the level of which (high or low) needs to be stored. For this purpose we modify our FF as in Fig. 3.

This FF is known as a D type FF and the reader can easily verify that the FF will set if D is high when the clock goes high, and it will reset if D is low when the clock goes high.

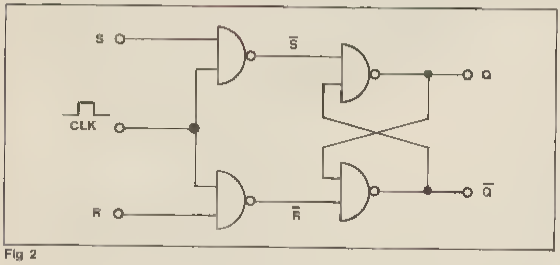


Fig 2

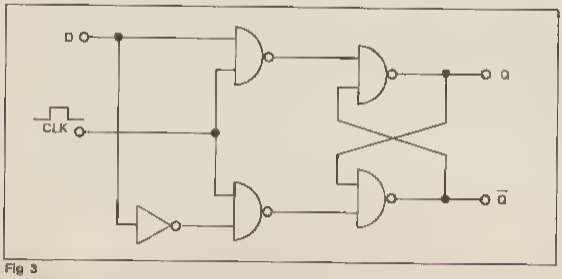


Fig 3

Some Applications

Since FF's can assume one of two states, they are ideally suited for storing binary data. Thus if we assume that if the FF is set it contains a "1" and if it is reset it contains a "0" we can place n FF's side by side and thus we manage to form a register containing an n-bit binary number. This number will remain in the register for reference or for use until we decide to alter it. Such a register could be implemented either by using D type or SR type FF's. An illustration of its implementation with D type FF's is given in Fig. 4.

Here the data is entered into this n-bit register by the common clock (strobe) line and is available for use or inspection on the 0_0, 0_1, 0_2 ... 0_{n-1} lines. Thus if we should wish to add two numbers contained in two such registers we would enable their respective outputs to an adder and the outputs of the adder will give us their

sum (An adder is a combination of gates It has two sets of inputs and one set of outputs and it is designed in such a manner as to give at the output lines the binary sum of the two binary numbers present at its input lines The adder does not have a strobe and it does not store the sum)

Another application of FF's is in the implementation of shift registers Here every time the command shift arrives the data in the shift register is moved one place to the right or one place to the left, depending on the design of the shift register As an example if we want to shift the number 01011100 one place to the left and put a zero in the least significant (rightmost) bit the outcome will be 10111000 The reader can verify that by doing so we have doubled the value of the number in the register

A possible implementation of a right shift register utilizing SR-type FF s is given in Fig 5

The shift register illustrated in Fig 5 is sometimes used as a de serializer – ie to convert serial input data (eg from a keyboard) to parallel data for use inside the computer

Flip Flops

The arrangement shown in Fig [illegible] can lead to some difficulty In every electronic device there is an inherent delay between the time the signal arrives at the input and the time the state of the FF is available at the output, this delay is sometimes called settling time or propagation delay

In our case (Fig 5) the settling time of the FF helps us to ensure that when the shift command arrives we shift into the (i+1)th stage of the shift register what is currently in the i th stage and not what is being shifted into from the (i 1)th stage

All very well you might say — where is the difficulty? Well all is very well provided the clock (shift) input does not stay high for a period longer than the settling time of the fastest FF If this should happen then we could have more than one shift while thinking we had only one This difficulty could be overcome by ensuring in the design stage that the clock (shift) duration is shorter than the propagation delay but this solution can sometimes be unsatisfactory To solve this difficulty and the difficulty of ensuring that the R and S inputs should not be simultaneously high – in deed to define a meaningful outcome to the occasion when this might happen and also make use of it – another advanced type of FF was invented

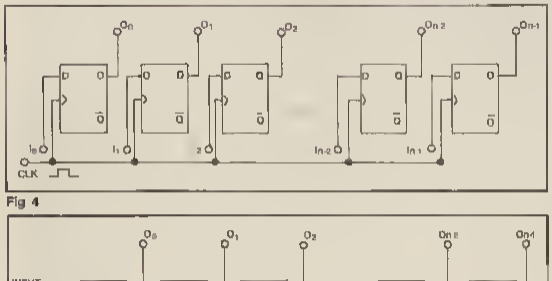


Fig 4

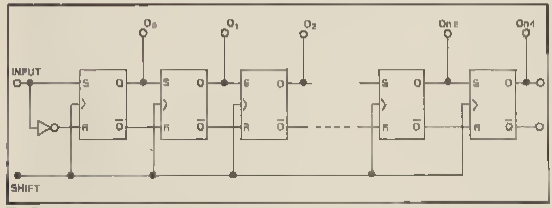
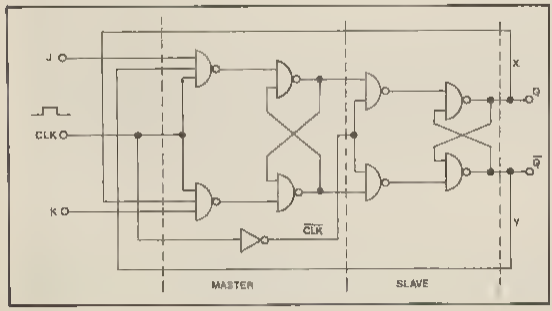


Fig 5



The JK FF

The JK FF in fact consists of two FF's in one The first is called the *master* and the second the *slave* therefore it is sometimes referred to as JK MS FF Referring to Fig 6 we can see that each of the master and the slave is identical to our synchronous SR FF, except for the fact that the slave is triggered when the clock goes *low*

This FF is in fact a two stage shift register with the first stage (MASTER) triggered by the leading edge of the clock pulse (going high) and the second stage (SLAVE), is triggered by the trailing edge of the clock pulse (going low) therefore the FF starts accepting the information on the leading edge and this information does not reach the output until after the trailing edge has arrived when the information is passed from the master to the slave So in this FF the trailing edge of the clock pulse is the important edge as far as *storing* the information in the FF is concerned because (a) it inhibits any further changes in the master and (b) it triggers the slave

This FF has another major advantage over the other FF s we have seen so far This advantage is associated with the feedback links (X) from the Q output to the K input gate and from the $\overline{Q}$ output (Y) to the J input gate This arrangement takes care of the situation when both the J and K inputs are *simultaneously* high when the leading edge of the clock arrives If the FF was set (Q = high $\overline{Q}$ = low) when this happened then the K input gate would be enabled and the J input gate would be disabled therefore the FF will reset On the other hand if the FF was reset (Q = low $\overline{Q}$ = high) when this happens then the FF will set So we can see that if both the J and K inputs were left high all the time then the FF will alternate in state after every clock pulse and in effect it provides a pulse at the output for every two clock pulses at the input – ie it divides the clock frequency by two and this characteristic of the JK FF is very widely used in the design of counters Because of the versatility of this FF it is perhaps the most widely used FF

Of course, now, with the increase in integration, it is possible to find many such FF's on a single chip organized in all sorts of fashions to provide registers shift registers counters etc

To conclude I have tried in this series of articles to give the reader a brief glimpse into the building blocks of digital electronics without pretending to provide tuition on the subject There are many textbooks on this subject and I am sure that if the reader's appetite has been whetted by reading this short survey he will find that the subject is very interesting and less difficult to understand than he might have thought before ■

• *Concluded*

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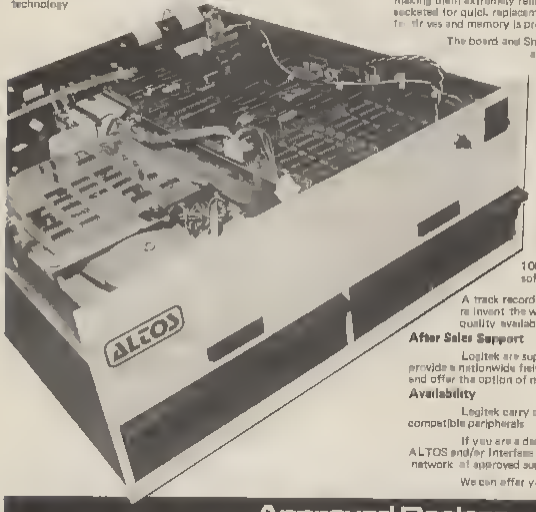

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He woke the robot up because even a manically depressed robot is better to talk to than nobody

'Night's falling' he said 'Look robot the stars are coming out'

The robot obediently looked at them then looked back

I know' he said 'Wretched isn't it?

We only ever had the one sun at home persecuted Arthur 'I came from a planet called Earth you know'

I know' said Marvin 'you keep going on about it It sounds awful'

Tell me' inquired Arthur 'do you get on well with other robots?'

Hate them' said Marvin

(From 'The Hitch Hiker's Guide to the Galaxy' by Douglas Adams 80p Published by Pan Books 1979)

TOPICS IN ARTIFICIAL INTELLIGENCE

Part Five: Computers And Speech

The extract above leaves the reader in no doubt that Marvin the residential robot of the Starship 'Heart of Gold' is intelligent. The widespread occurrence in science fiction of computers which exhibit such an amazing ability in understanding and responding to spoken commands has tended to create a climate in which the ultimate achievement of this level of performance by a machine is assumed to be already realisable, or at least only just around the corner. While perfectly understandable this prevailing attitude is in some ways unfortunate because it tends to take for granted the very complex processes which are required to overcome the obstacles standing in the way of constructing a machine which can understand even simple speech let alone the highly colloquial and conversational exchanges in the opening example.

Although in this article we shall focus on the problems of automatic speech perception, in a wider context it can be said that this and the next article deal with the general problem of man machine communication using *natural language*. In other words, we are seeking to free the user of say a computer system from the necessity of specifying programs in a highly constrained and formal artificial language (such as a normal programming language) and instead allowing him to use the sort of unconstrained conversational method of communication usually adopted between human beings in everyday situations (natural language).

It is immediately apparent that there are two distinct problem areas which need to be tackled here. On the one hand we might envisage a system whose commands instructions data and so on are communicated to a computer in natural language format but through the medium of say a keyboard (that is by means of *written* language). The problem then is one of manipulating the written text in such a way as to extract its meaning. This is the general area of Artificial Intelligence referred to as Natural Language. Under

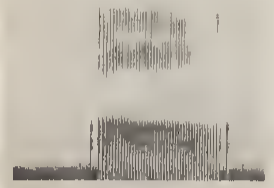

Figure 1.

standing, and will be discussed in some detail in the next article, where it will become clear that this in itself represents a large area of research

On the other hand we may wish to produce a system with which a human communicates by means of the *spoken* word. We can view this problem as adding an extra dimension of complexity to a natural language understanding system since before the meaning of the input data can be extracted it is necessary to transform the pattern of sound waves produced by the speaker into a form suitable for processing by the 'understanding' part of the system.

In this article we shall look mainly at some of the problems involved in speech signal recognition – in other words, the processes by which a spoken utterance may be recognised, at least to the extent of producing a representation of that utterance in a form suitable for further computer processing for the extraction of its meaning.

Description of speech signals

Let us first look briefly at the way in which speech signals are produced. The whole speech process is initiated by air being expelled from the lungs and through the cavities of the nose and mouth where patterns of excitation are stimulated, culminating in the emission of a sound wave into the surrounding environment. Very often the passage of air includes the setting up of oscillations in the vocal chords to generate pulses of energy to excite the vocal cavities. The actual characteristics of the uttered sound then depend on the resonances induced by the nasal and oral cavity shapes which are, of course, changed by movements of the mouth, lips and tongue. Speech may be broken down into very simple units (phonemes) which correspond to the 34 or so basic different sounds which may be produced. Some of these phonemes – those which we shall refer to in the course of this article – are listed in Table 1.

It is possible also to assign each phoneme to one of a small number of categories determined by the physical mechanisms of its production by the vocal apparatus. Consider, for example, the production of an isolated vowel sound such as the phoneme æ (see Table 1). This sound is produced by a resonance in the open oral cavity with the tongue forward. The vowel sound ɑ is similarly produced but with the tongue pushed more to the back of the mouth.

Another class of phoneme consists of the so-called fricative sounds. These are produced by a process whereby air is forced through a constriction formed at some point in the air passage to generate random noise which subsequently excites cavity resonances. In the case of the fricative phoneme f, for example, the constriction is formed by a suitable conjunctive positioning of the lips and teeth, while the sound v – a voiced fricative – is produced in a similar way but with the addition of resonances excited by the vibration of the vocal chords.

As a final example, consider a phoneme such as ɡ. This is produced in yet another different way by building up pressure with the mouth closed and then suddenly opening up the cavity with a simultaneous excitation of resonances from the vibrating vocal chords. The ɡ phoneme is an example of a plosive sound which in this case is voiced.

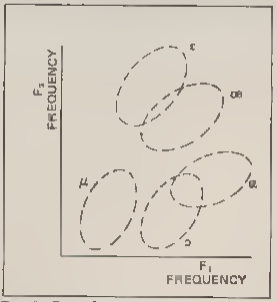

Fig. 2 *F_1 — F_2 scatter plot for some vowel sounds (individual points not shown)*

Frequency characteristics of speech signals

Each phonetic utterance will give rise to a fairly complex sound wave which issues from the vocal cavities. In general the signal will be a combination of components with different frequencies and intensities. A convenient way of representing such an utterance is in the form of a type of three dimensional graph known as a sound spectrogram, an example of which is shown in Figure 1. The horizontal axis corresponds to time and the vertical axis to frequency. The third parameter or variable defining the signal is intensity which is represented in the spectrogram by the darkness of the trace at any point.

The spectrogram shown in Figure 1 shows the typical idealised form expected for a vowel sound. The most noticeable feature of the spectrogram is that there exists some high intensity excitation in distinct and well-defined frequency bands. These in fact correspond to the resonant frequencies of the vocal cavity with the shape assumed for the production of the particular vowel, and are referred to as *formant frequencies*. In practice a number of formants might be identified for any particular sound, and would usually be labelled F F_2, F_3 and so on from the lowest frequency to the highest frequency. For our present purpose, however we shall limit our discussion in general to just the first two formants.

An approach to automatic speech recognition

The relative positions of the formants in a signal are most important, since they convey a great deal of information which is of value in identifying an utterance. Let us illustrate this by considering a method by which it is possible to discriminate between some simple vowel sounds.

A feature of vowel sounds is that they are produced by an articulation mechanism in the vocal apparatus which is fixed. In other words, to produce a vowel sound the vocal organs assume an appropriate position and the sound is produced by the vibration of the vocal chords. Thus fixed shape and function of the vocal cavities means that the formant frequencies for the utterance do not change with the time during its production.

Figure 2 shows a typical scatter plot of measurements taken on frequencies of the first two formants for a number of different speakers articulating a number of different vowel sounds. It can be seen that a very high degree of discrimination is possible even with a measurement of such simple parameters as these. That is, the clusters of points corresponding to the different vowel groups are largely disjoint and show little overlap. Indeed it has been shown that the whole set of vowel sounds may be distinguished to a relatively high degree of accuracy by means of simple measurements of the frequencies of only the first two formants. In principle, the accuracy of a system using this technique might be improved by considering in addition the position of higher frequency formants. In this case though

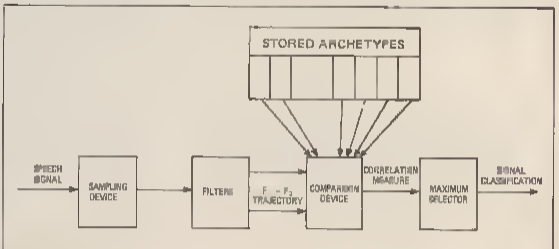

Figure 3

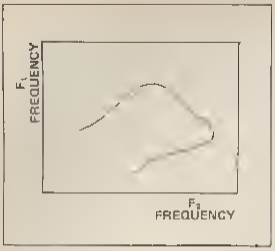

Figure 4

the dimensionality of the problem would increase and the decision surfaces become more complex

With other phonemes the situation is not usually so clearly defined since many utterances require the movement of the articulatory organs during their production, and a consequent change in formant frequencies is observed as the vocal cavity changes shape In this case the formant positions would describe a time-dependent trajectory across the F_1 -F_2 axes rather than occupying a fixed position in formant space This characteristic of many phonetic sounds is typical of a wider range of utterances and will now be investigated further in the context of a practical system for accomplishing a simple speech recognition task

Practical speech recognition

The simplest form of speech recognition system is one which is required to classify single words spoken in isolation A spoken word is produced by enunciating a number of phonetic sounds in sequence Thus in the course of articulating a word the vocal organs produce a speech signal in which the formant frequencies change in relation to each other over the duration of the utterance

A technique which may be used to identify a word spoken in isolation and which is based on this formant information is illustrated in Figure 3 and operates as follows The speech waveform is sampled at a number of discrete time intervals (perhaps every 30 milliseconds or so) and within each time slot the first and second formant frequencies measured These positions may then be plotted on a graph with F_1 F_2 as axes and will trace out a trajectory such as that depicted in Figure 4 If the word to be recognised is known to belong to a limited set of possible words (the *vocabulary* of the system) then it is possible to compare the trace produced with a typical or archetypal version of each of the words in the vocabulary selecting the word which gives the closest match as identifying the utterance

The performance of this type of system will, of course, depend on a number of factors For example, an increase in either the vocabulary size or the similarity between the words in that vocabulary will be likely to produce a degradation in the performance of the system Likewise the variation in the vocal characteristics of different speakers will unusually mean that performance will be worse if the system is used by a large number of different speakers than if it is restricted to a smaller number (As an exercise, consider what safeguards might be introduced to minimise this problem) Within this latter area one particular problem to be considered might be the way in which regional accents can distort phonetic utterances and particularly vowel sounds Consider, for example the variation in pronunciation of the word 'bath' by a BBC announcer, a Northerner and a Cockney

Recognition of connected speech

It will readily be appreciated that the recognition of a string of words – a sentence, for example — compounds the difficulties involved in isolated word recognition

The additional difficulties arise for a number of reasons In speaking a continuous sequence of words we tend to articulate individual sounds less precisely viewing the entire message as a coherent unit rather than a collection of sub units Related to this, a most severe problem is that word boundaries are often not well defined and it becomes unclear which sounds are to be regarded as making up any particular word A further difficulty arises from the fact that in connected speech the articulation of a particular phonetic sound may be affected by the sound immediately preceding and/or following it Likewise a phoneme may be omitted altogether when, for example shared between the end of one word and the beginning of the next

In practical systems for the recognition of connected speech it is acknowledged that the information obtained from a straightforward analysis of the speech signal itself is rarely sufficient for recognition even of fairly simple sentences In practice it is necessary to combine such information with information related to the permitted grammatical and structural rules of the spoken language (syntactic information) and the context of what is being said (semantic information) in order to identify the utterance with a greater degree of confidence Figure 5 shows the block diagram of a possible design for a connected speech recognition system

Speech understanding systems

In recent years it has become more usual to talk in terms of systems for speech understanding rather than speech recognition In other words, for most practical applications it is not necessary to produce a word-for-word translation of a spoken message but rather to extract from it some representation of the meaning it is intended to convey Thus the requirement of very high accuracy of individual speech unit recognition may be relaxed in favour of a performance criterion which relates more to the degree to which a system may interpret the meaning of and act appropriately upon, spoken commands It is clear that a system which satisfies criteria expressed in these terms is likely to rely much more on syntactic and semantic information than on the simple extraction of phonetic information The problems associated with this idea of understanding natural language and the techniques involved in the implementation of a system to carry out this kind of task will be introduced and discussed in the next article in the series ■

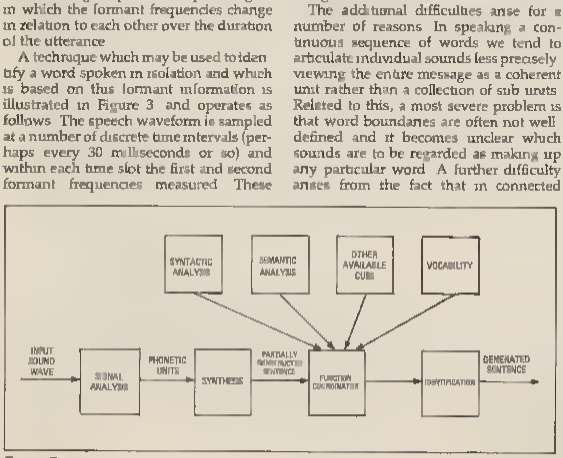

Figure 5

PHONEME SYMBOL	PHONEME SOUND
æ	a as in "dad"
ɑ	a as in "jard"
f	as in "fish
v	as in "vain'
ɛ	as in "get
ʊ	as in 'rude
ɔ	as in "ford

TABLE 1 Some phonemes and their characteristic sounds

● *Dr Fairhurst is at the Electronics Laboratories of the University of Kent at Canterbury*

Previous articles in the series have dealt with representation in problem solving planning a strategy pattern recognition and computer vision The first article appeared in Issue two

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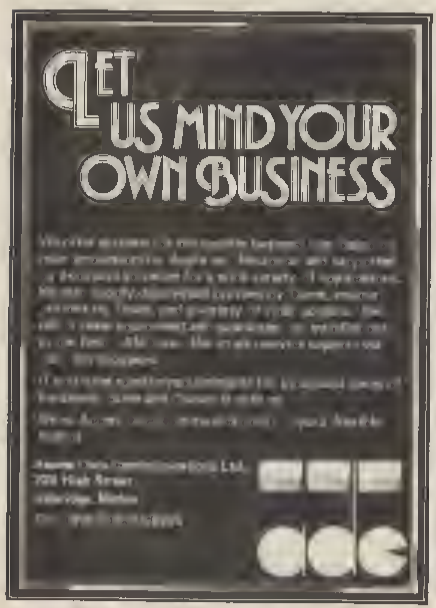

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HIGH-LEVEL LANGUAGES FOR MICROS

Lyndon Morgan has worked as a [illegible] Computing Division at the National Physical Laboratory since July 1969. He is currently Managing Consultant, Data Systems and editorial director of the Publications Handbooks of the NCC. Microprocessor Development Kits, High Level Languages and Applications for Microprocessors.

Many people felt and no doubt many still do, that the advent of the microprocessor meant a return to real computing. A return to the days when you spent hours writing, studying and optimizing binary code — investigating every intricacy of the processor architecture and machine code.

Others, notably Professor Edsgar Dijkstra, were concerned that the microprocessor would set computing back 20 years simply because we would ignore the lessons we had learned so painfully.

The trade offs between a high level language and assembly-level or machine-code language are well known. They apply equally in microprocessor and microcomputer applications and in conventional computing. There will always be occasions when it will be necessary to use assembler level or access the processor architecture. However the demands of labour costs, maintainability and reliability will always make the use of a high-level language essential.

Given that we are going to use a high-level language for our micro, we are left with the questions:

- what languages are available?
- what are the differences?
- which should I use?

At the NCC I have been in charge of a project aimed at just these questions. At a conference I attended last October the statement was made that: 'There are only about 3-4 languages available on microcomputers.' Well, that is far from the truth. In our forthcoming book on high level languages at least 16 languages are identified and that list is not exhaustive. In fact if you can think of a language you can find it available on a micro. How good that particular version may be or which micros it will run on may vary widely. Nevertheless the languages are available. In this article I shall be tracing the development of high-level languages and their descendants, those available for microprocessor work.

The concept of a high level programming language started in the 1950s, in particular with the FORTRAN project in 1954. This language was designed to translate mathematical formulas into machine code so that a computer could solve the problem. The main aim of this exercise was to speed up the writing of programs. At one time it was thought that the whole idea was impossible but slowly and at great cost a working system was developed that by 1964, produced the well known language FORTRAN IV.

What languages are available? What are the differences? Which should I use?

During the FORTRAN project discussions took place between several bodies in Europe and the USA over the development of an international algorithmic language (IAL). Several attempts were made such as JOVIAL (Jules Schwartz Own Version of the International Algorithmic Language) and ALGOL 58. By further development the Algol 60 language was produced and definitively described by the "Revised Report on the Algorithmic Language Algol 60" in 1962.

Although many other languages were being developed, FORTRAN IV and Algol-60 became the dominant ones and provoked endless discussions as to which was the better.

Algol and FORTRAN were of course closely related to mathematics and scientific calculation, this being a reflection of the use and users of computing at that time. As the use of computing spread so new languages developed. The most significant was COBOL which was designed to meet the needs of commercial programming. It was not mathematical in style and was designed to resemble conventional English as closely as possible.

In Great Britain the need for a real time programming language saw the design of CORAL, a development of JOVIAL incorporating some of the ideas of Algol-60. In America the need to provide engineers with an online computing facility saw the development of BASIC from FORTRAN IV.

There were also a number of highly specialised languages appearing which bore little or no resemblance to the mainstream of language development. Important languages of this type were APL and LISP. APL was designed as a general notation for describing array and vector calculations and only later became a programming language. LISP was designed for artificial intelligence work.

In the late 1960s IBM brought out their attempt to combine the best of all the major languages into one language, PL/1. The principle of this language was that it contained facilities for all types of programmers, but an individual programmer need only learn a particular subset. The concept did not find wide acceptance, particularly with other manufacturers and the individual languages have flourished. There was also a major development of Algol 60 that led to Algol 68. This is a very powerful language but has had limited application. During the 1970s RTL 2 was developed as a real-time language by Imperial Chemical Industries Ltd.

As you will see from figure 1, there is a

long gap after RTL/2 before we see any new languages appearing These new languages have been prompted by the appearance of the microprocessor Thus we have PL/M PLZ/SYS and MPL which have been produced by the microprocessor manufacturers Other languages have received a new lease of life most notably PASCAL PASCAL was first developed in 1969 However apart from use in Universities and Colleges for teaching purposes PASCAL was hardly heard of Now it is one of the most published languages because of its use on microprocessors In America a software house FORTH INC developed the FORTH language

The other language to emerge has been BASIC which was designed to give engineers a calculator like facility at a computer terminal It was easy to use and easy to learn Hence when the hobbyist market in microcomputers sprang up BASIC was adopted developed and refined and is now probably the most widely used language on microprocessors and microcomputers

In 1979 we had the announcement of

Overview

ADA a language designed for the United States Department of Defense for all its real time programming ADA is likely to become a very important language for microprocessors in the 1980s

Having looked at the historical development of the languages let us now look at each language in turn

ADA

The United States Department of Defense had hundreds of different languages and language implementations in use Consequently in 1975 the STRAWMAN project was set up to define a Common High — Order Programming Language Thus specification went through three refinements (WOODMAN TINMAN IRONMAN) until the STEEL MAN project in 1977

This project asked four teams to specify a language to meet the stated requirements

The language definition selected was

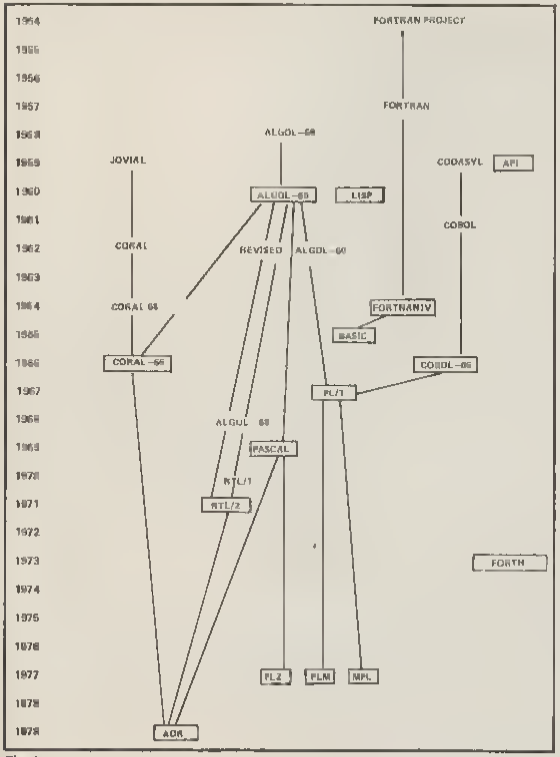

Fig 1

that designed by the team led by Jean Ichbiah of CII [illegible] named ADA after Countess Lovelace who worked with Charles Babbage and is considered to be the first programmer

An important part of the development is the PEBBLE MAN project which is defining the whole development [illegible] for ADA This will cover [illegible] editors and testing and development

ADA is based on PASCAL but has added facilities for parallel processing and exception handling

Algol-60

Algol-60 is one of the classic programming languages It introduced such techniques as recursive procedure calling block structuring and dynamic store allocation It was designed as a formalised method of specifying solutions to essentially mathematical problems (algorithms) As its original definition did not define Input and Output commands this has been a weakness of the language

Algol 60 has been used in the areas of mathematical computing It is available for most microprocessors and microcomputers

APL

APL was designed as a notation for handling strings of data (vectors and arrays) It has been in use on mainframes (particularly IBM) since the mid 1960s but has not enjoyed widespread popularity APL makes great use of symbols which means that it is very concise but that programs need to be backed up by considerable documentation to aid comprehension

Users of APl stress the usefulness of APl in interactive business systems Most business systems are effectively based on arrays and vectors of data which APL handles very efficiently Consequently what if type applications are easy to set up and run As an example of APl consider the following which would compute the *average* of a set of numbers

$$(+/\omega)\div\rho\omega \leftarrow \square$$

Note that we do not have to provide the number of numbers we wish to average Although there are only a few implementations available on microcomputers APL has much to commend it is well worth considering using and more implementations will be forthcoming

Pascal

Pascal was designed in 1969 by Nicklaus Wirth In the last few years Pascal has come to public attention and that has been due to its availability for microprocessors With its foundations in Algol 60 Pascal added a defined method of input and output and importantly the idea of *typed data* This idea significantly reduces program errors For example if we define a data type DAY by the statement

```
TYPE DAY = (SAT SUN MON TUE WED
THUR, FRI)
```

Then any variable of type DAY could only take one of the values in brackets Also another type could be defined.

```
TYPE WEEKDAY = (MON ... FRI)
```

A variable of this type could only take one

of the value MON TUE WED THUR FRI

Several versions of Pascal are available In particular the University of California (San Diego) has produced a popular version available on many microprocessor systems A BSI (British Standards Institute) standard for Pascal is due for publication soon

The UCS Pascal compiles into an intermediate code (P code) Western Digital Inc have implemented this code as the machine code of their PASCAL MICROENGINE

PLZ; PLM; MPL

Three of the main microprocessor manufacturers have developed languages for their own system software development

Zilog Corporation based theirs on PASCAL and called it PLZ SYS which shares a common kernel grammar with an assembler level language PLZ ASM Thus language is only supported on the Zilog MCZ or ZDS micro computer systems

Overview

Intel Corporation based their language on PL/1 and called it PL/M It runs on the Intellec microprocessor development system It can run under the ISIS operating system or for real-time use under RMX/80

MOTOROLA also based their language on PL/1 and called it MPL It was specifically designed for programming ROM RAM type applications using the M6800 It is also supported for the M6800 series

Although they are high-level languages all three languages give good access to the processor architecture and assembly level features

CORAL 66

CORAL 66 was designed by Royal Signals and Radar Establishments (RSRE) for the development of real-time computing systems

An official definition of the language was published in 1970 and CORAL 66 was adopted as the preferred language for Ministry of Defence (MoD) projects CORAL 66 has also been adopted as the recommended language for Department of Industry use CORAL 66 is implemented on most microprocessors

In order to maintain standards all implementations of CORAL 66 have to pass the IECCA (Inter Establishment Committee for Computer Applications) assessment before being accepted for (MoD) use

RSRE also developed a system for the design and development of software called MASCOT (Modular Approach to Software Construction and Test) Implementations of MASCOT provide CORAL 66 with a run time executive and parallel processing facility

CORAL 66 translators are available for most microprocessors through such companies as Systems Designers Ltd GEC and Ferranti

RTL/2

RTL 2 was designed by Imperial Chemical Industries Ltd in 1971 It was designed for real time computing in such areas as online data collection and data communications and control systems RTL 2 is a task oriented language a *task* being made up of code and data to perform a *given function* The same code may appear in different tasks and parallel processing of tasks is allowed

ICI Ltd made RTL/2 commercially available through SPL International Ltd in 1974 Microprocessor-based versions of RTL/2 are available from SPL and other companies such as HPAC Versions exist for most of the popular microprocessors

FORTRAN

FORTRAN is one of the oldest high level languages It has enjoyed great popularity amongst scientists and engineers despite its lack of features like block structuring and recursion and its limited conditional statements There are microprocessor and microcomputer applications but the 80 column card conventions still exist

Simply because of its widespread use to date it will be popular on microprocessor based projects although, on a more rational basis for selection it may now be outdated

BASIC

BASIC is very much the personal computing language Being designed for easy learning and use by non computer people it was ideally suited for personal computing It is almost universally available on microprocessors and microcomputers However it is often difficult to pin down what you mean by BASIC There are so many versions and variants that BASIC is practically several languages masquerading as one You can have a 2-4 k version of BASIC providing block structuring and a 2 k version not providing it! Also the following statement is interpreted in

totally different ways by two well known BASIC interpreters

A$ – B$(5 7)

Nevertheless BASIC is easy to learn and use and is excellent for one off jobs or jobs of limited scope particularly where the programmer is not a computer person However many would say that APL, for instance, has much to offer in the same area

COBOL

COBOL is probably the most widely used of all programming languages Thus is because it has been adopted as the standard programming language for business and commercial systems COBOL aims to be very close to written English Thus one can write statements like

```
IF ITEM1 IS EQUAL TO ITEM2 THEN ADD ITEM3 TO ITEM4
OTHERWISE IF ITEM1 IS LESS THAN ITEM2 THEN MOVE 0 TO ITEM4.
```

COBOL also provides good facilities for the definition of Data items and File structures However this is only achieved by the rather cumbersome structure imposed by the four COBOL divisions

IDENTIFICATION ENVIRONMENT DATA and PROCEDURE

COBOL was designed before the advent of the interactive style of operation Nevertheless microcomputer based versions of COBOL offer good facilities for the development of VDU based systems a number of the COBOL implementations on microcomputers are sufficiently compatible with main-frame COBOL to allow

Overview

the following style of program development

The COBOL programs can be run on their own microcomputer or alternatively the COBOL programs Where these programs (or modules) are written and tested they can be transferred to the mainframe In this way the problem of overloading the mainframe with development and testing program development by long turnaround can be overcome at reasonable cost

FORTH

FORTH is an interesting language for like APL it does not have its roots in any of the conventional languages FORTH was developed by FORTH Inc an American software house

It is available on a number of minicomputers as MiniFORTH On microprocessors there is the MicroFORTH language and also PolyFORTH which allows multi programming and multi user operation

FORTH consists of a set of supplied words and can be extended by user defined words As an example of this approach here are some FORTH functions to generate Morse Code

```
QON     — switch on a lamp
QOFF    — switch off a lamp
TENTHS  — cause a delay of 1/10 sec
```

Then we could define the following FORTH words

```
DOT QON TENTHS QOFF TENTHS
DASH QON TENTHS TENTHS TENTHS QOFF TENTHS
SAY TENTHS
S DOT DOT DOT SAP
— DASH DASH DASH SAP
HELP D A S H API
```

MicroFORTH is available on M6800 RCA 1802 Z80 and PolyFORTH on 8080 8085 8086 TI 9900 and DEC LSI 11

FORTH has been covered in a series of articles in COMPUTER AGE by Gil Filbey

Conclusions

Faced with this range of languages, what can the prospective programmer do? Not only must you pick a language but you have to select an implementation of the language when the language support facilities must be evaluated Simply to pick the language you know may mean you are missing out on a whole new field of programming (eg COBOL vs APL for commercial work) Also to stick with one language may not be sufficient and you may have to write in more than one of these languages

All in all this leaves the programmer with an interesting and challenging development to his career ■

• **High Level Languages For Microprocessor Projects**, by David Taylor & Lyndon Morgan with a foreword by Professor David Aspinall of UMIST is a new book published by NCC Publications Oxford Road Manchester

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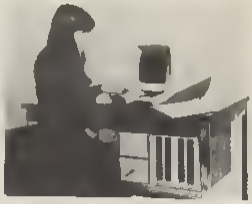

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BRAND NEWs 6

compiled by Microspy

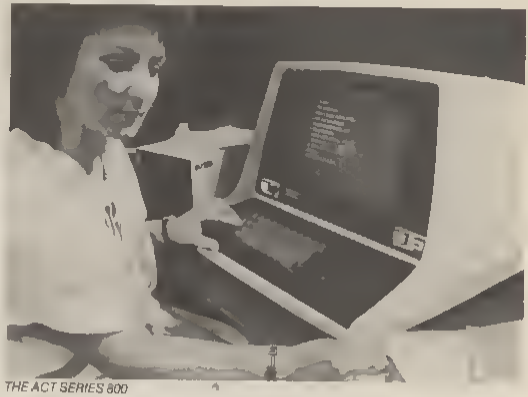
This middle section may either be pulled out or photocopied then filed for reference. It will be comprehensive and range over the whole field of products, services, events and courses. **PU** stands for Personal User. **SB** stands for small base – that is small budget or small business. **MB** – medium base, medium budget or medium business. **BB** – big base, big budget or big business.

Systems

ACT

A new micro offering many features and facilities has been introduced by ACT of Birmingham. Known as the *ACT Series 800*, it is based on a 2MHz hybrid 6502 microprocessor and provides more than 108 Kbytes of memory of which 48 Kbytes are in RAM. Magnetic data storage ranges from 800 Kbytes on two floppies to 4.8 Mbytes on four 5¼ drives. The *Series 800* is designed and manufactured by Compu/Think Inc. of California. *Additional hardware features* 1920 character screen and graphics capability. *Software* ROM-based BASIC and O/S. Additional applications software from ACT. Price range £3,950 – £7,450 (+ VAT). **SB**

Applied Computer Techniques (Holdings) Ltd, 5-6 Vicarage Road, Edgbaston, Birmingham B15 3ES
Tel: 021 454 5341



THE ACT SERIES 800

BCL

The *Molecular 80* – the latest in the BCL family of microcomputer business systems. The system starts with one visual display unit and electronic keyboard, a matrix printer, high capacity exchangeable discs and a central processing unit. Adding extra peripherals – including remote terminals – such as line printers, discs and VDUs, the basic system can grow in line with rising workload.
BCL will be supplying a range of commercially oriented applications packages, the bases of which have already been tried and tested on other computers using SIMPLE, enhanced by BCL in line with experience gained from installation of over 700 computer systems in the UK. A typical price for a *Molecular 80 configuration with two VDUs, a 240 lines per minute printer, 64 Kbyte central processing unit and 10.6 Mbyte disc unit will be £25,500.* **MB**

Business Computers (Systems) Ltd, The Pagoda, Theobald Street, Borehamwood, Herts WD6 4RT
Tel: 01 207 3344

The Molecular 80

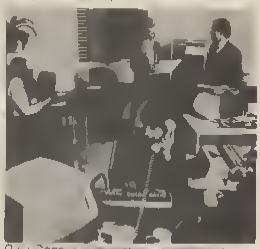
BURR-BROWN

The *CS 450* is a general purpose microcomputer system (keyboard, display, cpu, 32K of RAM memory and mass storage facilities) with the addition of a number of special interfaces, a real-time clock/calendar and special software. Potential applications all involve capturing data, processing real-time. System can issue control signals, provide status information or commands to an operator or record processed results on floppy disk. An Autostart facility loads the program at power on, allowing operation by unskilled personnel. **SB, Engineers**

Burr-Brown International Ltd, Cawsbury House, 11-19 Station Road, Watford, Herts WD1 1EA
Tel: (0923) 33837, Telex: BB WFD G 922481

DATA GENERAL

The *CS 50 System* is Data General's latest addition to its fully compatible Commercial System family of small business computers. The *CS/50* handles typical business applications such as order entry, inventory control and general accounting for companies in the £3.25M to £13M range, or for localised operations of larger corporations. The new system offers fast interactive response for up to nine terminals for concurrent data entry access. **MB** (Data General)



Data General (UK) Ltd, Hilton House, 724-736 London Road, Hounslow, Middx TW3 1PG
Tel: 01-572 7445, Telex: 935364

GEEST COMPUTER SERVICES

A new family of low-cost microsystems aimed at business, scientific and engineering users has been announced by Geest Micro Systems. The new range are all based on Texas Instruments microprocessors. Known as the *G 3, G 4* and *G 5*, the new systems fit between Geest's existing G 10 and G 12 minicomputer systems which are also based on Texas Instruments technology. Prices range from around £7,000 for the first time user *G 3*, comprising 64k RAM processor, floppy

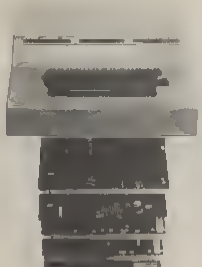
disc unit display terminal [illegible] for a powerful G5 control [illegible] Mbyte hard disc and a faster processor. Software applications packages which are all available for rental include stock recording, sales purchase and nominal ledgers, payroll and a library of engineering packages. Other packages are under development. **MB** Texas Instruments)
Geest Micro Systems Centre City House, Hill Street, Birmingham B5 4UB
Telephone 021 643 3013

LION MICRO COMPUTERS

Complete business system package for £4 000. The system is based on the Commodore PET with software supplied by Radio Computer Services Ltd. The system hardware is configured with a 32K version of the PET microcomputer, a Commodore 3040 dual disc drive and the Commodore printer. The software package is from two separate sources. Radio and PETSOFT. The Radio Accounting System handles all ledger accounting by recording information onto books of prime entry and then automatically updating the appropriate ledgers. The system is capable of handling 300 sales accounts, 300 purchase accounts and 90 nominal accounts with up to 2 500 entries in any one month. Also included in the package is the PETSOFT Stock Control System. **SB** (PET)
Lion Micro Computers, 227 Tottenham Court Road, London W1
Tel 01 580 7383

NASCOM

A new modular desk top microcomputer was launched by Nascom. The *System 80* is a flexible system based on the Nascom 2 board and consists of a frame, racking which can take up to 5 boards, a power supply and a fibre glass housing. Provision is made for further expansion. Other new products announced to go with the *System 80* are 16k 48K memory boards, high and low resolution colour graphics boards, high resolution character generator board and a floppy disc sub system to be available in the Summer. New software including CP/M operating system will also be available. *Example of system costs*
32K System £505
48K System with colour graphics £820
As above with twin disc (560 Kbytes) £1 355
(All prices exclude VAT)
PU, Education
Nascom Microcomputers, 92 Broad Street, Chesham, Bucks HP5 3ED
Tel (02405) 75155, Telex 837571



BRAND NEWs

SINTROM ELECTRONICS

The *Pentfex 630 48 System* [illegible] 5¼" Micropolis mini floppy drives with 18 Kbytes of random access memory. Disc capacity with two single sided drives is 630 Kbytes expandable to 1.2 Mbytes. The Sintrom System Integration package which includes true turnkey operation up to two serial and three parallel peripherals and industry standard CP/M or Micropolis MDOS is included with the system. High level languages include BASIC E, CBASIC, FORTRAN 80, CIS COBOL, APL, PASCAL, ALGOL and MICROSOFT BASIC. There are also a wide range of applications packages including word processing, CP/M software also includes PIP, DDT and STAT for system programming and ASM for the development of 8080/8085 assemble programs
Price [illegible] £2 500. **SB**
Sintrom Electronics Ltd, Arkwright Road, Reading, Berks RG2 0LS
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U-MICROCOMPUTERS

The *C2 OEM* new computer from OSI features nominally 48K RAM, dual 8" floppy discs, serial port for VDU and printer interface – for only £1 800. The processor used is the 6502. It will run OHIO's business disc operating system – OS65U. Database Management System OS DMS and the extensive range of applications software now available. The *C2 OEM's* BUS oriented with two slots used in the base system and 6 free. It comes in a single case. Expansion to OHIO's range of hard discs is possible. The C2 OEM can form a distributed processor in OHIO's networking system. **SB MB** (OHIO Scientific)
U Microcomputers Ltd, P O Box 24, North wich, Cheshire CW8 1RS
Tel (0606) [illegible]5 7390, Telex 666592

Applications

CINCOM

The Manufacturing Systems [illegible] Cincom Systems announces MRP (Manufacturing Resource Planning System)
MRPS is an on-line computer software system developed by Cincom for use in manufacturing environments to develop a master plan, establish and control material requirements, inventory capacity orders, work load and every detail of manufacturing activity. Depending on configuration the cost of MRPS ranges from £24 000 to £91 000 for purchase or leases at up to £990 per month
Cincom Systems International SA, St ives House, Maidenhead, Berks
Tel 0628 29456

COMMODORE

Commodore has launched a new word processor package known as the WordPro II. It is specifically designed for use with the 16K and 32K big keyboard versions of the PET. The WordPro is floppy disc based together with special ROMs. The package costs £75 and could be easily installed in conjunction with the 2040 dual floppy disc unit and is capable of processing up to 303 pages of text. **SB** (Pet)
Commodore, 818 Leigh Road, Slough Trading Estate, Slough, Berkshire
Tel Slough 74111

COMPSOFT

Compsoft announces enhancements to its information storage and retrieval system DMS. Running on microcomputers (recommended by Commodore for the 32K PET) it is a powerful and flexible set of programs designed to bring the power of the small computer to the non computer expert. Up to 5000 items may be stored on a single floppy disc with each item being immediately accessible by a key that can be up to 16 characters in length. Items may be created, updated and deleted as many times as required without the user having to worry about file organisation or needing any computer knowledge. **SB** (Pet)
Compsoft Limited, Old Manor Lane, Chilworth, Guildford, Surrey
Tel Guildford (0483) 39665

COMPUTERPLAN

Computerplan has developed a new Subscription Circulation Software Package written for Data General Business Basic which enables small to medium sized publishing houses to carry out all the normal clerical and accounting functions associated with publishing journals on a subscription and/or controlled circulation basis.
The system allows for a number of different journals, subscription types, agents, discount rates, methods of despatch, currencies, subscription rates and methods of reader/subscriber classification.
The new package runs on the Data General MicroNova, Nova and Eclipse range of mini computers. The price of the software package is £3 750. Computerplan combine their subscription/circulation package with Data General equipment to offer a turnkey system for publishers from under £18 000. **SB MB** (Data General)
Computerplan Ltd, 65 Staines Road, Hounslow, Middlesex
Tel 01 572 0395

DATABANK

Databank has cut the cost of its off the shelf software packages.
Software is available for:
Commodore Pet (Printout & Cassette)
Apple II (Printout, Cassette & Floppy disc)
ITT 2020 (Printout, Cassette & Floppy disc)
Exidy Sorcerer (Printout & cassette)
The latest addition to Databank's range — 14 programs for Apple II, ITT 2020 floppy disc users. These programs are supplied on disc at a time off price of £10 5 for £20, 10 for £30 & 14 for £35. **PU** (Apple Pet, ITT 2020, Sorcerer)
Databank Software Services, 66 Queens Road, Loughborough, LE11 1HD
Tel Loughborough (0509) 217671

DIGICO

Scan Data Centres Ltd of Haywards Heath has developed a fully computerised point of sale system for independent retailers based on Chubb Cash CR3/220 POS terminals. Scan Data who have been designing retail control systems with POS equipment for over five years for chemists, hardware, shoe fashion and photographic outlets have now standardised their system on the Digico Consort range.
The total system comprises a Consort 128K byte processor, dual double sided floppy disc drives, a Regent VDU, a data cartridge handler, an Okidata 120 cps matrix printer and Chubb Cash CR3/220 terminals. **SB MB**
Digico Ltd, Wedgwood Way, Stevenage, Herts SG1 4PY
Tel Stevenage (0438) 4381

BRAND NEWs

HALLMARK COMPUTERS

Hallmark Computers has launched a mini computer based system with all the routine functions necessary to run a mail order business. The mail order system which has taken two years to develop carries out operations from the initial promotion and order processing through to product fulfilment and management reports. It has been designed to be simple to operate flexible in terms of currency changes simultaneous promotions and numbers of subscribers. Can be run by a secretary or clerk. Cost of the complete Hallmark Mail Order System including all the hardware and application programs can vary from £20 000 to £80 000 depending on the size of the business operation **MB**

543-560 High Road, Chiswick, London W4
Tel: 01 994 6692

HOTEL MICROSYSTEMS LTD

Developed for BRE Ltd a sophisticated hotel room status and door locking system which communicates using the existing hotel coaxial television cable. They have also developed a front office reservations and guest billing systems for which TSR Ltd have been appointed marketing agents. HMS are now expanding and entering the end user market with a product range embracing selected equipment used in the hotel systems. Of special interest is the Sanders Varo Printer which has many features including software selectable fonts proportional spacing and the ability to justify text itself. It can print with true letter quality output on single sheets of paper or with high speed listing type faces. **SB**

473 Staines, Bedfont, Feltham, Middx
Tel: 01 890 9696

NCC

As part of its examination of microprocessor and microcomputer software The National Computing Centre has just completed studies in two major areas: application packages and the availability of high level languages. As a result of these studies which included collecting and collating information from over 100 suppliers of microprocessor based software the Centre plans to publish comprehensive guides on the packages and languages. Later this year. These studies showed that high level language compilers and interpreters are widely available. Information was collected on many languages and their different compilers. Fifteen major languages were identified: PL/M, PLZ/SYS, MPL, CORAL 66, RTL/s, ALGOL 60, FORTRAN, COBOL, PASCAL, BASIC, BCPL, LISP, APL, PILOT and FORTH. Over 80 different application package types were identified involving a total of 600 different product items. The most widely available packages were for accounting, order processing, addressing and mailing and payroll. Most of the software packages fall in the price range £500 — £1000 but some can cost as much as £3000. Typically hardware and software are being sold as a complete system with hardware costs in the range of £5000 — £7500. Some systems with large disc capacity can cost £12500. **SB**

The National Computing Centre, Oxford Road, Manchester M1 7ED

TANDEM

Tandem manufacturers of the NonStop computer system announces the availability of MUMPS a high level interpreted language designed for data management. Tandem MUMPS is intended for applications such as interactive data entry and inspection, manipulation of text and encoded data and data sharing. The Tandem MUMPS also supports all the features of the ANSI 1977 MUMPS language standard but differs from other implementations in that it runs under Tandem's own Guardian operating system and Enscribe file system. As a result, Tandem MUMPS users will be able to execute concurrently Cobol, Fortran and TAL programs and take advantage of the features available on the NonStop system including running in a fault tolerant mode. **MB**

Tandem Computers Ltd, 18/21 High Street, Uxbridge, Middx UB8 1LA. Tel: 0895 57001

SIA COMPUTER SERVICES

SIA Computer Services has released an improved version of MOSS (Version 4) developed and supplied by the MOSS Consortium. This comprehensive highway design and ground modelling system has been mounted and tested on the SIA CYBER POWER Computer Service and includes all previously available options such as ground survey analysis, highway design sections, quantities, automatic plotting etc. **MB**

PLANNERS (Cyber)

SIA Ltd, Ebury Gate, 23 Lower Belgrave Street, London SW1W ONW
Tel: 01 730 4544 Telex: 916635

SCAN COMPUTERS

The Sussex based turnkey computer business Scan Computers Limited is now offering customers of its Texas DS990 hardware a new and comprehensive pensions administration package known as SYSTEM 80. Developed by pensions administration specialists United Pension Services Limited of Bristol, SYSTEM 80 is designed to enable companies to administer their own pension schemes without resorting to batch processing of pension records through a computer bureau.

SYSTEM 80 allows for immediate access to and display of scheme membership records on VDT screens. It provides full maintenance of current deferred and pensioner records, immediate access to and calculation of member benefits and full analysis of membership changes. The system also produces Member Benefit Statements and DHSS Termination Reports as standard. Optional extras to the package will include Payroll for Pensioners, Accounting Records, Investment Records and Actuarial Valuations. Runs on Texas DS990 family of computers.

SB, MB

Scan Computers Ltd, 34 South Road, Haywards Heath, Sussex RH16 4LA
Tel: Haywards Heath (0444) 59742/57771

TEKTRONIX

Tektronix Inc supplier of multi vendor (universal) micro processor development systems will begin offering software development and debugging capabilities for the Zilog Z8000 and Intel 8086 16 bit microprocessors in the second quarter of 1980 and the Motorola 68000 microprocessor in the third quarter of 1980. The TEKTRONIX 8002A Microprocessor Development Lab (MDL) which already offers complete development support for Texas Instruments 16 bit TMS9900 and SBP 9900 now becomes the first system committed to support all four major 16-bit microprocessors. **OEM**

Analog Intel Texas Instruments)
Tektronix UK Ltd, Beaverton House, P.O. Box 69, Harpenden, Hertfordshire
Tel: Harpenden 63141 Telex: 25559

ZEUS-HERMES

Announces VIDECOB an interactive Cobol editing package for terminal systems on ICL 1900, 2903/4 and 2900 computers. VIDECOB has been designed to reduce the repetitive aspects of Cobol programming. It replaces the various facilities provided in Cobol compilers for updating and copying Cobol files and in addition provides a set of editing tools not available from the compilers. Videcob is fully compatible with all ICL program maintenance utilities and is available both as an integral part of the Zeus Hermes TP Monitor Cortez or as a free standing program based on ETS/MTS. Communications Manager or Cortez (ICL. **MB, BB**

Zeus Hermes Ltd, 172-174 Tottenham Court Road, London W1P 9LG
Tel: 01 388 2393

Disks

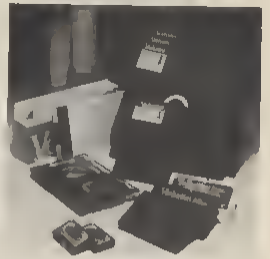
BALL CORPORATION

The BD100 rack mountable 100 Mbyte disc drive featuring 5 R/W surfaces. Access time track to adjacent track 5mS, maximum tracks (0 to 815) 55ms and average 30ms. Pack rotation speed 3600 rpm with start time 20mS. Options include rack or pedestal mounting. Also available Ball disc controllers with error correction variable record length and multiple drive capability. CPU interfaces for various minicomputers. **MB, OEM**

Technical Products Group, UK, 20 Oxford Road, Newbury, Berkshire
Tel: (0635) 30770 Telex: 847139

BFI ELECTRONICS

The complete range of VERBATIM magnetic data storage products include floppy discs with double sided double density and mini-versions, data cartridges, data cassettes and



magnetic cards. Claimed to be the largest range of its type in the world. **PU, SUB**

BFI Electronics Ltd, 516 Walton Road, West Molesey, Surrey KT8 0QF
Tel: 01 941 4066 Telex: 261395

▶

BRAND NEWs

DATA EFFICIENCY
DISCOFLEX is the name for a new style of mini floppy disc storage from Data Efficiency Ltd. This fan file type box will accommodate 20 Mini Floppy Discs in transparent inner pockets for safe and space saving filing in the working area. The fan file guarantees fast filing and instant retrieval. **PU, SB**

Maxted Road, Hemel Hempstead, Herts HP2 7LE
Tel: (0442) 57137/63561 Telex: 825554

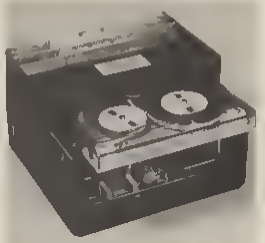
PENNY & GILES
A range of magnetic drive products including 1. CD 701 OEM Cartridge Drive for DC 3000 type cartridges providing up to 4 megabytes of storage, full ECMA 46 compatibility, 1600 bpi and an optimum specification for OEM use. 2. Minifile 6000 Floppy Disc Data Store using the Basf 608 minifloppy disc and can store up to 51 Kbytes of data per mini diskette. 3. Module Z100 Bulk Date Store in a mag-type data cartridge based store which can handle up to 3 megabytes of data per cartridge and provide rapid access to any one of 400 possible files. **OEM, PU**

Mudeford, Christchurch, Dorset
Tel: (042 52) 71511 Telex: 41266

PETSOFT
The ACT PETSOFT Disc is a complete stand-alone system for the Commodore Pet allowing up to 800 000 bytes of mass data storage online. Designed by Compu/Think for business use, this double density system offers complete random or sequential file access and support. The Disc Operating System is in ROM which plugs directly into the new ROM 16K and 32K PETs with large keyboards. Old ROM 8K PETs will require an Expandamem Memory Expansion board. The Disc Operating System adds 9 additional operating system commands and seven additional extended [illegible]

Aimed at business users, the PETSOFT Professional Disc system is available in two configurations offering 400 000 or 800 000 bytes of storage online. Prices start at £795 + VAT. Developed by Californian Disc technology specialists Compu/Think, the system has already proved itself to be reliable and easy to use. **PU, SUB** *(PET)*
Petsoft, P.O. Box 9, Newbury, Berkshire RG13 1PS
Tel: 0635-201131 Telex: 339396

SINTROM ELECTRONICS
PERISTORE HD 6400 cartridge recorder. A major application of this new device is for the safe dumping of data from Winchester technology disc drives. Data is transferred to and



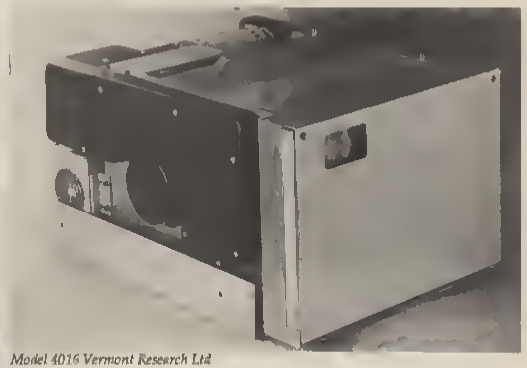
from the drive at 192K bits per second and recorded on four serial tape tracks. **SB, OEM**
Sintrom Electronics Ltd, Arkwright Road, Reading, Berks
Tel: 0734 85464

SYSTEM INDUSTRIES
A Data General 96 and 192 Mbytes Zebra range compatible disc controller is available from SI (Europe). It offers full compatibility with DG's Nova I/O and software. **OEM** (Data General)
System Industries (Europe), System House, Guildford Road, Woking, Surrey GU22 7QQ
Tel: Woking (048 62) 5077 Telex: 859124

VERMONT RESEARCH
Model 4016 head per track device, fast access non volatile memory with capacity up to 4 MBytes, capable of operating from 117/230 VAC 50/60 HZ or 48 V DC and in hostile environments. MTBF greater than 15000 hrs. Used widely for message switching, process control etc. Wide range of interface adaptors and controllers available. **MB, OEM**
Vermont Research, Cleave Road, Leatherhead, Surrey KT22 7NB
Tel: Leatherhead 76221 Telex: 23280 (Vermont Lthrhd)

Printers

ANADEX
The new Anadex DP 9500 and DP 9501 printers are currently available at £895 and £955 respectively (one off end user price) and provide 132 to 220 column alphanumeric printing and high density graphics with a fine resolution dot matrix head.
Three ASCII compatible interfaces and a 700 byte buffer are provided as standard with an option of an additional 2K buffer if required.
The full 96 character ASCII set includes true descenders and underlining of all upper and lower case letters and printing is bi-directional on five copies at speeds reaching 200 cps.
Adjustable width tractors accommodate



Model 4016 Vermont Research Ltd.

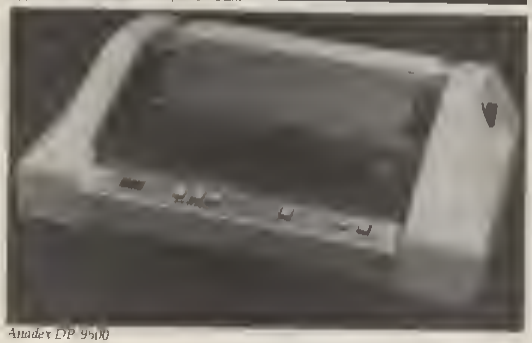
paper from 1.75 to 15.8 inches. **PU, OEM, SB**
Anadex Ltd, Dorne House, Guildford Road, West End, Woking, Surrey
Tel: (09905) 6333

RAPID RECALL
A new full size floppy disc drive known as the RX02. Developed by DEC for the LSI 11 and PDP 11 families and can be operated as either a single or a double density dual drive unit. The unit comprises two flexible disc drives, a R/W electronic module, a micro based controller module and a power supply. Maximum storage capacity is 512 Kbytes/disc (1024 kbytes unit). Average access time is 263ms. **SB, OEM** (DEC)
46-50 Beam Street, Nantwich, Cheshire
Tel: (0270) 626061 Telex: 36329

DATA DYNAMICS
The ZIP KDP is a single compact computer terminal comprising a keyboard, VDU and printer.
The VDU can be moved from side to side for the operator's convenience. It has a 12" screen and the character presentation is in 5 x 7 dot matrix and can be in either 12 or 24 lines

BRAND NEWs

of 80 characters. Several standard user selectable options are available.
The printer has 9 x 7 dot matrix, 30 cps, full upper and lower case ASCII printer. **OEM**

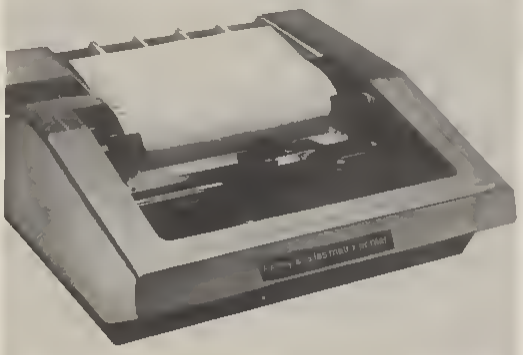


Amadek DP 9510

MEMEC
NEC TELECOMMUNICATIONS LTD have appointed Memec Systems Ltd as their UK representative and distributor for the printer range — the NEC Spinwriter.
The Spinwriter range is an entry by NEC into the word processing quality printer market. Competing directly with the Diablo and Qume daisywheel printers, the Spinwriter uses a print thimble with little inertia giving high speed and quiet operation. **OEM SB MB**
Memec Systems Ltd Thame Park Industrial Estate Thame Oxon OX9 3RS
Tel (084 421) 5471 Telex 837506

PENNY & GILES
A new 8080 based programmable bi-directional 80 column printer with print speed of up to 130 cps, multiple character set and a graphics option.
It uses 7 x 7 dots and a density of 10 characters per inch or 5 chars per inch expanded character mode. It contains 1 Kbyte data buffer and has a choice of interfaces. **PU OEM, SB**

TELEPRINTER EQUIPMENT LTD
Paper Tiger is the latest in a range of quality printers. Combining fast print speed, selectable character sizes, selectable interface and graphics dot plotting, Tiger will adapt to virtually any system or application. Selectable line speeds mean that data can be output to the printer at up to 120 cps and the 2K buffer



with a full 24 x 80 CRT screen. All page widths of up to 9½" the ability to print multipart forms. **SB**
Teleprinter Equipment Ltd 70 82 Akeman Street Tring Herts HP23 6AJ
Tel (0442 82) 4011 9 & 5551 Telex 82362 BATECO G (ables Tring

VDUs, Graphics, Terminals & Systems

DATA DYNAMICS
Data Dynamics offer two low cost visual display units as part of their complete range of computer peripheral equipment. They are the DD/912 and DD/920. Both models have a full alpha numeric keyboard with an integral numeric keypad and are identical except that the DD/920 incorporates a row of eleven function and 8 editing keys. Both units can be operated in a conversational or block transmission mode.
Each has a 12" non-glare screen and will display up to 1920 characters arranged as 24 lines of 80 characters. The full upper and lower case ASCII character set can be displayed in a 7 x 10 dot matrix format with 12 x 10 resolution. Addressable and manual cursor control is standard as are such features as data protect, underlining and block transmission. Tabs can be set and cleared either from the keyboard or from line. **OEM, SB, MB**
Data Dynamics Springfield Road Hayes Middx
Tel 01 848 9787 Telex 935424

DATA GENERAL
Two video display terminals, the DASHER D/100 and D 200. The new terminals which are priced below the firm's current line can be used with Data General's full range. **SB MB**
(Data General)
Data General 3rd & 4th floors Hounslow House 724 734 London Road Hounslow London TW3 1PD
Tel 01 572 7455

ELECTRONIC BROKERS
A limited supply of the advanced Modular One series Hazeltine VDU is now being marketed by Electronic Brokers Ltd at less than half the original price.
The VDUs are part of a special purchase by the company and are refurbished to as new condition, tested and offered with full warranty and spares.

Prices are £425 for the basic version and £695 for the add plus VAT and carriage. **PU, SB** (Hazeltine)
Electronic Brokers Ltd 49/53 Pancras Road London NW1 2QB
Tel 01 837 7781

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KINGSTON

KINGSTON — KRK 1

A hardware repeat key for the PET number/cursor pad — a boon to the busy programmer and the ambitious games programme writer. Aided by the detailed instruction programme the average PET owner can upgrade his machine in a couple of minutes without fear of a fatal no-no.

£17.95

KINGSTON — KRK 2

Initially the KRK 2 was conceived as a definitive full keyboard repeat key. However Kingston ingenuity has optimized on their patented board accessing techniques to allow two invaluable features to be added.

The first a warm keyboard reset from otherwise fatal crashes. The second a selectable keyboard tone which allows touch entry at otherwise impossible speeds. We can say with confidance that this unit is an absolute must for any PET user who wants to get the best from his machine.

£35.00

KINGSTON — KC 1

A totally new concept in PET's communication with the outside world. At long last the programmer is free from the limitations of the IEEE bus. INPUT, PRINT, LOAD and SAVE to an external RS232 device are now possible without recourse to ingenious/tedious software. A comprehensive on board firmware package allows all manner of hitherto impossible functions to be achieved including keyboard selectable configuration with full modem control.

£139.95

KINGSTON — KC 2

Having achieved one level of impossibilities we knew someone would need more so here it is.

Simultaneous access to two RS232 serial devices or networks with all the features of the KC 1 and more besides. With this device we give PET users serial RS232 I/O capabilities which the owners of much more expensive machines would envy.

£190.00

KINGSTON — RSB 1

A twenty way RS232 multiplexing/switching box with mind blowing potential — Applications of the unit are legion and range from simple networking through multiple disc sharing to multidevice complexes based on a single processor.

£260.00

CMC ADA 1200

A low budget IEEE 488/RS232 unidirectional interface with a proven record of reliability (Field failure rate better than 1 percent). Since the unit is not addressable it is not recommended for use with the Commodore Disc.

£99.00

CMC ADA 1400

An addressable IEEE 488/RS232 unidirectional interface which is proving even more reliable than the ADA 1200 from which it was developed. While it was designed to offer only standard RS232 output it is sufficiently beefy to cope with a number of less demanding current loop applications without modification.

£90.00

CMC SADI

SADI — The microprocessor based serial and parallel interface for the Commodore PET. SADI allows you to connect your PET to parallel and serial printers, CRT's, modems, acoustic couplers, hard copy terminals and other computers. The serial and parallel ports are independent allowing the PET to communicate with both peripheral devices simultaneously or one at a time. In addition the RS232 device can communicate with the parallel device. Special features for the PET interface include:

- Conversion to true ASCII both in and out.
- Cursor controls and function characters specially printed
- Selectable reversal of upper and lower case
- PET IEEE connector for daisy chaining
- Addressable — works with other devices

Special features for the serial interface include:

- Baud rate selectable from 75 to 19200
- Half a full duplex
- 32 character buffer
- X ON X OFF automatically sent
- Selectable carriage return delay

Special features for the parallel interface include:

- Data Strobe — either polarity
- Device ready — either polarity

Complete with power supply, PET IEEE cable, RS232 connector, parallel port connector and case.

£175.00

CMC AIM 161

A low budget IEEE 488 16 channel analogue to digital convertor for the competent programmer who wants to do his own thing. With a 5 12 volt reference voltage the unit is normally accurate to better than 5%.

£90.00

CMC PETSET

An AIM 161 specially configured for plug-in and switch on use by the less technically graced user. The unit has a number of helpful extras including an input connector board allowing simple screw connection to the outside world.

£134.95

CMC APPLESET

Similar to the PETSET saving that the unit is configured for use with the APPLE.

£139.00

CMC TANDYSET

Similar to the PETSET saving that the unit is configured for the TANDY TRS80.

£135.00

CMC XPANDR 1

Analogue to digital conversion of up to 128 channels can be achieved by simply connecting as many 16-channel AIM 161 units as you need through this smart board.

£80.00

TNW Corporation

TNW 2000

With over 2 000 units sold this IEEE 488 RS232 interface can truly be said to be tried and tested. Features include the conversion of both PET and true ASCII, daisy chaining and full address selection.

Standard RS232	**£139.00**
Current Loop	**£154.00**

TNW 3000

A bi ported bi directional IEEE 488 RS232 interface offering everything the discriminating programmer could ask for. Features include independent crystal controlled Baud rate on both ports and fully implamented RS232 with extensive control line options allowing responsive throttling.

£220.00

SSM — A1d

Two powerful APPLE interface boards in one.

The first an RS232 serial with three handshaking lines (RTS, CTS and DCD), rotary switch selection of nine standard baud rates from 110 to 19200 including 134.5 for selectrics and the modes of serial communication under software control.

The second a double bi-directional parallel with four additional interrupt and handshaking lines and interface configuration under software control.

£114.00

NOTES

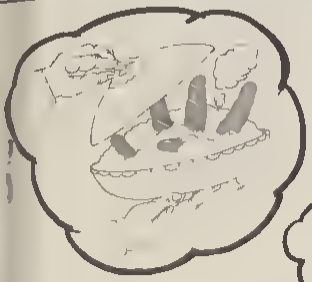
1. Every Kingston product is carefully burned in and tested before dispatch.
2. Kingston's guarantee, warranties and service undertakings are probably the best in the business. If you would like to see what real customer concern is all about then send for a copy of our standard Guarantee Form!
3. All prices quoted by Kingston are inclusive of packaging and shipping but do not include V.A.T. — Please add 15% V.A.T. to any order.
4. We have a number of new and exciting products in the pipeline including:
   (a) A family of rugged, low budget EPROM programmers and duplicators.
   (b) A number of new cost effective printers including daisywheels and single and double pass (better quality) matrix.
   (c) A low cost TAS expansion.
   (d) A flexible expandable industrial control system.
   (e) Emergency standby power units ranging from a 5 KVA baby to a 9-5 KVA mainline system.

If you have an interest in any of these items, give us a call. As you might expect from a company which prides itself in being different, we maintain an engineer on call eighteen hours a day, seven days a week to help you.

KINGSTON COMPUTERS LTD

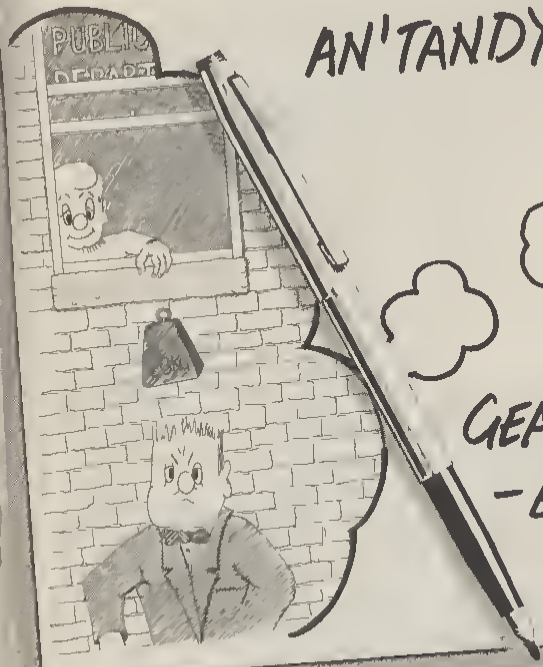
Scarborough House, Scarborough Road, Bridlington. Telephone 0262 73036

THIS MONTH WE NEED A LAYOUT THATS TASTEFUL DISCRETE & FORCEFUL - OK?



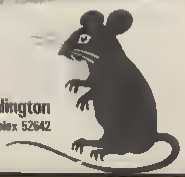
GET YER PET APPLE

AN' TANDY



GEAR 'ERE - BOOM BOOM!

OH VERY DROLE !!



Kingston Computers Ltd · Scarborough House · Scarborough Road · Bridlington
Telephone 0262 73036 Telex 52642
A member of the Dale Group of Companies

BRAND NEWS

FEEDBACK LTD

LOGATEL automatically answers calls when a line is unattended. The caller identifies the distinctive answering tone and then dials his own number on his telephone receiver.

LOGATEL logs the number and stores it together with the telephone numbers of other callers who have phoned during the person's absence. When he returns he simply touches a switch and the numbers received are displayed one after the other. £50 (+ VAT) per unit. **MB 88**

Feedback Ltd Park Road Crowborough Sussex
Tel 08926 3322

INTERSCAN

Interscan announces that Dex 5100, the new Group III digital facsimile terminal has received Post Office approval.

The 5100 is the high performance nerve centre of the Dexnet range. It is capable of sending an A4 document in just 20 seconds and has available a number of advanced features which enables the 5100 to talk to all Group II terminals, automatic document feed, full duplex operation and an auxiliary copying facility. **MB 66**

Interscan Ltd 39 Montrose Avenue Slough SL1 6BS
Tel Slough (0753) 70821 Facsimile Slough 37442 Telex 849952

IDA

Priced under £1,000 [illegible] 1111 Transactor from Inventa[illegible] Electronic Solution Ltd captures data on a [illegible] cartridge in a format ready for [illegible] Anyone at the same time performs all the functions of an independent transaction station, producing printed cash receipts. **OEM**

International Data Automation Ltd 1 Station Parade, Virginia Water, Surrey GU25 4AB
Tel (09904) 4944

IMLAC

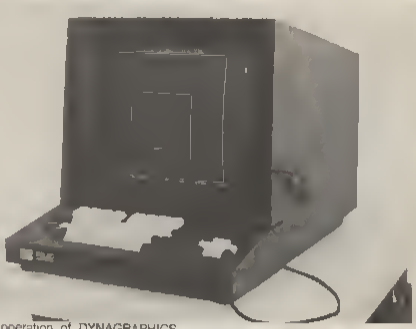
IMLAC 3205 terminal for general design. Focal point of system is IMLAC's high definition low reflectance flicker free screen fully addressable area. Contrast ratio of around 30:1. Picture files maintained exclusively by on board processor. A second processor provides full intelligence by running DYNOG — program for controlling all variable speed terminal/host/terminal communications supervising operation of DYNAGRAPHICS hardware features other peripherals. Character generation scissoring vector generator fast operation ensure extremely low response times. System facilities include a host resident suite of programs providing software interface to user's Fortran applications programs. User may develop own routines drive terminal from host.

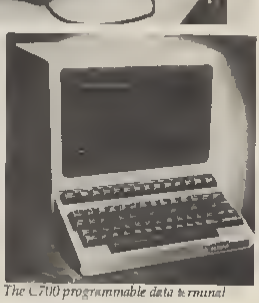
IMLAC International Ltd IMLAC House 17 Chesham Road Amersham Bucks HP6 5HN
Tel (02 403) 22167

KGM ELECTRONICS

The C700 programmable data terminal. It is a flexible unit offering up to 16K of ROM and 64K of RAM. It incorporates multiple character size, smooth screen roll and extensive control sequences and communication facilities. Extra capacity or interfaces can be easily added and there is a choice of three keyboards: a 128 character computer keyboard, selective format text editing keyboard or separate plug in numeric pad. **OEM**

KGM Electronics Group Clock Tower Road Isleworth Middlesex TW7 6DU
Tel 01 568 0151 Telex 934120





The C700 programmable data terminal

LEAR SIEGLER

Business graphics capability is now available on Lear Siegler ADM 31 and ADM 42 video display terminals.

Featuring more than 10 graphics characters including corners, t bars, crosses and vertical and horizontal lines the enhancement can produce such graphic elements as bar charts, flow and mimic diagrams and a myriad of customised business forms. For hard copy output the terminals can be linked to printers and plotters that have an RS232

The IDA Transactor

BRAND NEWs

interface **OEM, SB, MB**
Lear Siegler Products Ltd Orchard House Connaught Road Brookwood Surrey GU24 OAT
Tel Brookwood (048 67) 80666/7 Telex 859415

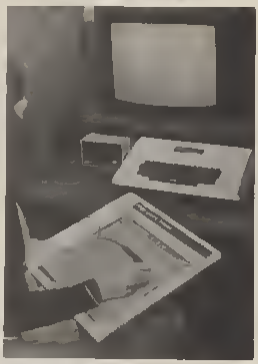
LYME PERIPHERALS
The Lyme 4000 family consists of five VDU models 4002 3 4 5 and 4006 The character format is a 12 x 7 dot matrix and it has 90 non reflective keys including numeric pad
OEM, PU SB MB
Lyme Peripherals Ltd 2 Avenue Court Farm Avenue London NW2 Tel 01 452 0490

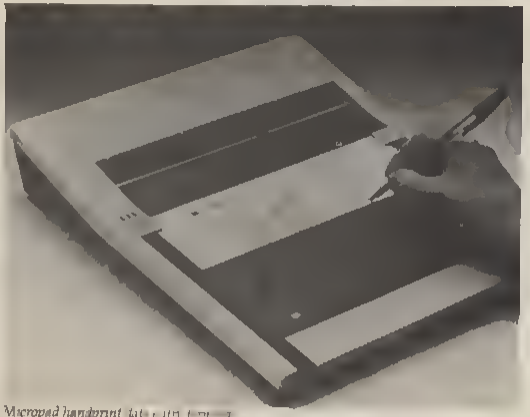
MICROPAD
Micropad — the world s first handprint data entry terminal — captures handprinted data entered for immediate processing It is priced at £1 725 **OEM, SB MB**
Micropad Ltd Whittle Road Ferndown Dorset BH21 7SD
Tel Ferndown (0202) 891518 Telex 41358

MICROSENSE COMPUTERS
The Apple Graphics Tablet is a device which converts the position and movements of a special pen into digital information which the Apple can then use in conjunction with its graphic display to produce free hand drawings **PU, Education, Designers** (Apple)
Microsense Computers Limited Finway Road Hemel Hempstead Herts HP2 7PS
Tel 0442 63561 Telex 825554 DATEFF G

PRAGMA LTD
The VISUAL 200 is a new low cost microprocessor based video display terminal It features 24 x 80 screen format, 7 x 9 dot matrix upper/lower case numeric pad etc Current loop or RS 232 interface **PU, OEM, SB, MB**
Pragma Ltd Middlesex House 29 High Street Edgware Middlesex HA8 7UU
Tel 01 952 8471 Cable Pragma Edgeware Telex 922625

TEKTRONIX
VDU terminals with Video Out can now be connected directly to the Tektronix 4632 Hard Copy Unit providing high quality paper copies of screen displays at the touch of a button A multiplexer is also available to share the copier between up to 4 video sources **SB, MB OEM ENGINEERS**
Tektronix UK Ltd Beaverton House P O Box 69 Harpenden Hertfordshire
Tel Harpenden 6914 Telex 25559 ▶





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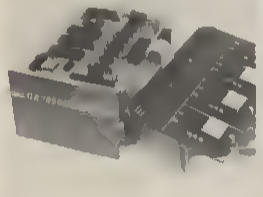

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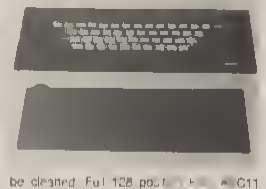

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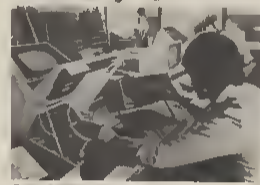

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Literature

BURR-BROWN
Burr Brown have published a handbook on their range of analogue input/output and related digital input/output plug-in boards for microcomputers. These boards are available ex stock for most microcomputer development systems and OEM micro computer board families including those from Intel National Motorola Zilog and the Digital Equipment Corporation. The brochure provides the designer with an overview of the architecture of the various boards available and includes a table which presents the most significant specifications of all the board types. The brochure is freely available to all engineers and managers directly concerned with the implementation of microcomputer based systems.
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2 Intel's ISIS 11 Pocket Guide

IPC
Microprocessors and Microsystems is an international journal on microcomputer technology and application for designers. It is published 10 times a year by IPC Science and Technology Press Ltd P O Box 63 Westbury House Bury St Guildford Surrey GU2 5BH Tel Guildford (0483) 31261

ABACUS SOFTWARE
Abacus Software announces the availability of the PET machine language guide. This manual is intended to help the PET owner who would like to progress beyond the PET's native language BASIC. The guide is available for $7.95 + $2.00 Air Mail postage from
Abacus Software P O Box 7211 Grand Rapids Mich 49510 USA Barclaycard and Eurocard are acceptable.

MOI
More information have just published a new Microcomputer Books catalogue (Feb '80). For further information
1 Francis Avenue St Albans AL3 6BL
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DATA DYNAMICS
Data Dynamics have published a brochure on their 1180 series of paper tape punches. The brochure describes the specifications of the popular 1180 family and includes descriptions of the training maintenance and service agreements that are available from the company
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Tel 01 848 9761 Telex 935429

TOPEXPRESS
Topexpress Cambridge scientific and computer consultants announce the availability of the first of a new series of manuals for the TRIPOS operating system. TRIPOS A New comer's Guide is aimed at users with little or no experience of advanced computer operating systems. Current uses of TRIPOS include accountancy systems insurance broker systems educational systems scientific systems and experimental monitoring and control systems
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PETSOFT
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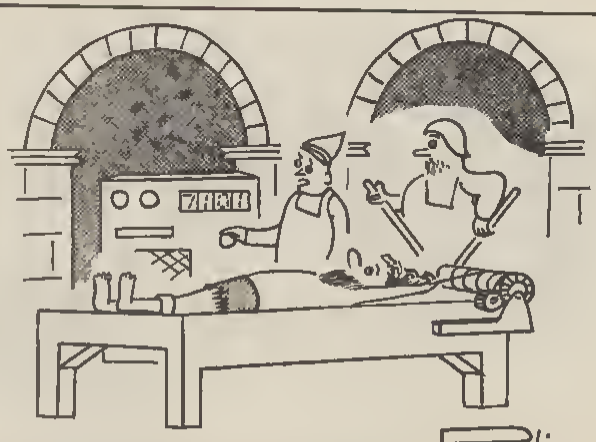

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CHARACTERISTICS OF INTERPRETERS

Most users of small systems are familiar with the BASIC language and will perhaps be aware that many of the available versions of BASIC are interpreters. In order to drive devices which operate at high speed it is usually necessary to write assembly code subroutines called from BASIC and it is quite surprising to notice the difference in speed of these subroutines and the lines of BASIC which call them. For example many microcomputers have a command to clear the contents of the screen and this works fast enough to appear instantaneous but the equivalent BASIC program will seem painfully slow in comparison.

What exactly is the difference between assembly code and BASIC which results in this startling discrepancy in performance?

The answer of course is that BASIC is interpreted. A useful analogy can be made with a human interpreter. If I want to talk to another Englishman I will assume that he understands English and probably I will be able to communicate easily with him. However if I try to talk to a Russian I would find it almost impossible to carry on a conversation as my knowledge of Russian is very limited. As a way round this, I can employ an interpreter to translate my sentences as I speak them and then I will be able to have a fairly slow conversation with the Russian, pausing between sentences while mine are translated into Russian and his replies are translated into English.

The situation is similar with computers. Every computer has its own natural language which consists of its primitive machine code instructions. If you present a computer with machine code programs the computer will be quite happy but the effort of generating the instructions is considerable. It is not reasonable to expect a computer to understand the BASIC language as BASIC lines are not compatible with the machine code instructions which the computer expects. However there are programs available called interpreters which will work in a way similar to the human interpreter and which will allow us to write programs in BASIC which can be understood by the computer.

There is an alternative approach to be considered. If I want to communicate with Russians I can write letters in English which will be entirely translated into Russian. When the Russians read the letter they need not stop to think that the letter has been written in English and they can reply in Russian with another translation of their reply back into English for me to read. Using this method Russians can read my letters whenever they like and at their own leisure, speed. They will however have to wait a little longer before they can start acting on the contents of my letter.

Again there is a comparable situation with computers. Programs called compilers exist which translate complete programs into machine code and the advantages are similar to the use of the human case. The resulting machine code usually runs much faster but compilers are less suitable for interactive use as the whole of the program has to be translated before any of the work can be started. Getting the program right is also more tedious because if there are any errors the program must be edited and the compiler called up *again* whereas with an interpreter it is a relatively simple matter to correct a line and start the run again. In fact for interactive languages there is usually an inbuilt editor which means that users are not so aware of the separate stages involved in running a program as for other languages.

It may seem that there is a clear-cut distinction between compiled languages and interpreted languages but this is not really the case. Some languages are more suitable for interpretation than others but there are languages which can be compiled or interpreted. Languages which are normally interpreted include BASIC, APL and LISP while FORTRAN, Algol, Cobol and PL1 are normally compiled. Pascal exists in a number of compiled and interpreted forms at present.

Languages which are designed for interactive use such as BASIC are almost certain to be interpreted because the relationship between the user and the computer can then be closer. Most language systems actually compromise between interpretation and compilation the degree to which this is done giving the flavour of the language. BASIC is not normally interpreted directly from text as the overhead of translating each line is just too great, so when the lines are input during the edit phase keywords are reduced to a single symbol and constants and addresses of variables can be evaluated, leaving a compact form ready for interpretation when the user types RUN. Unfortunately it is not easily possible to fix addresses for GOTO and GOSUB statements because the target line of a GOTO or GOSUB may not exist or if it does it may change as the user corrects his program. It is common for BASIC interpreters to generate a linked list of the lines in numeric order, and processing of jumps during execution is likely to be slow as the interpreter scans the list to find the next line to execute. Of course this is not the only strategy for handling jumps but it is

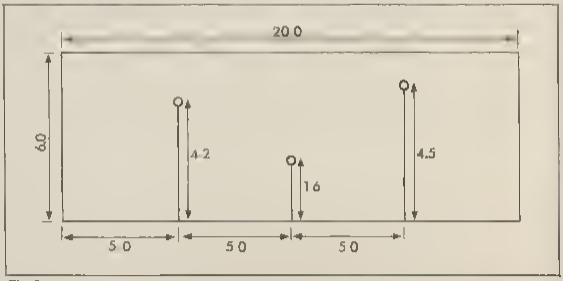

Fig 1

fairly convenient As an example of the use of interpretation in other languages the FORMAT statements in FORTRAN a language which is normally compiled are interpreted, which is one of the reasons why READ and WRITE statements are so slow in FORTRAN

For much more detailed information about interpreters for interactive languages Peter Brown's book makes excellent reading (1)

Now let us consider how interpretative techniques can help us to write programs Suppose a manufacturer has just approached you with the following problem He wants to drive a machine tool (which he has just bought) with the output from a computer in order to produce flat metal plates with holes drilled in them Each plate is 6 cm wide by 20 cm long and the holes are to be drilled in the pattern shown in fig 1 The tool has a number of basic operations which are

a Accept next workpiece
This operation takes a blank piece of metal and positions it in the starting position on the machine
b Move plate longitudinally to the right a distance d
c Move plate longitudinally to the left a distance d
d Move drill across the plate a distance d
e Move drill back across the plate a distance d
f Drill a hole
g Pass workpiece to next machine

It will be seen that the tool operates by moving the workpiece from side to side, and by moving the drill bit at right angles to the sideways movement When the workpiece is accepted at the start of processing the left hand edge of the plate is under the drill so for this particular operation it should never be necessary to use the move right instruction After a little thought you decide to write FORTRAN routines for each of the operations and as the manufacturer only wants to make a mere 500 000 plates you write him a FORTRAN program like fig 2

```
      DO 100 I=1,500000
      CALL ACCEPT
      CALL MOVEL(5 0)
      CALL UP(4 2)
      CALL DRILL
      CALL MOVEL(5 0)
      CALL DOWN(4 2-2 6)
      CALL DRILL
      CALL MOVEL(5 0)
      CALL UP(4 5-2.6)
      CALL DRILL
      CALL PASSON
  100 CONTINUE
```

Fig 2

This is fine but a month later your client comes back and asks you to modify the program because now he wants the holes in different places as part of a different batch You're not too worried by this and after a short while the new program is written and installed However this happens month after month and eventually he says to you 'Isn't there any way we can generate our own programs for this machine' Unfortunately none of his staff know much about computers so they may not take too kindly to writing FORTRAN program and there is the added complication that his machine is in fact too small to support the FORTRAN compiler although it will run the resultant program To date all the work has been done on your own computer It is clear to you that since the machine tool only has 7 basic operations and since none of the machine tool programs to date has exceeded 1000 lines of FORTRAN that it should be a simple matter to write an interpreter to do the job This will have the advantage that in the long run you will have fewer demands made on you and be less likely to make an expensive mistake in one of the monthly modifications How do you go about it? Firstly you will have to incorporate all the machine tool operations into a language preferably which the manufacturer's staff will find easy to use You think they will accept the following set of statements

```
ACCEPT
MOVE LEFT n
MOVE RIGHT n
UP n
DOWN n
DRILL
PASS ON
```

Although it is possible to describe the processing for a single plate by these instructions it is not possible to describe the repeated operations required for a whole batch of plates so you decide to give them a few new commands which are

```
COUNT n                 Set a counter to n
REPEAT ON COUNT LABEL n Decrement the
                        counter by 1 and
                        if it is non zero
                        branch to label n
LABEL n                 Defines a label
```

Thoughtfully you decide to make the language free format so that statements can be written anywhere on a line The previous program now looks like

```
      COUNT 500000
LABEL 1
      ACCEPT
      MOVE LEFT 5 0
      UP    4 2
      DRILL
      MOVE LEFT 5 0
      DOWN  1 8
      DRILL
      MOVE LEFT 5 0
      UP    1 9
      DRILL
      REPEAT ON COUNT  LABEL 1
```

or can even be written as -

```
COUNT 500000 LABEL 1 ACCEPT MOVE
LEFT 5 0 UP 4 2 DRILL MOVE LEFT 5 0 DOWN
1 8 DRILL MOVE LEFT 5 0 UP 1 9 DRILL
REPEAT ON COUNT LABEL 1
```

This is not the most elegant programming language in the world but you think it will prove suitable for the application

The program does not have to be performed at great speed because it takes a few seconds for each drilling operation

The target machine has a version of BASIC which you can use to write the interpreter Let's see how you might go about writing it

At first sight it looks easy and you write

```
10 INPUT A$
20 IF A$="ACCEPT" GOTO 9000
30 IF A$="MOVE LEFT" GOTO 9100
40 IF A$="MOVE RIGHT" GOTO 9200
50 IF A$="UP" GOTO 9300
60 IF A$="DOWN" GOTO 9400
70 IF A$ "DRILL" GOTO 9500
80 IF A$="PASS ON" GOTO 9600
9000 REM ROUTINE FOR ACCEPT
9010 GOTO 10
9100 REM ROUTINE FOR MOVE LEFT
9115 INPUT D
9110 GOTO 10
9200 REM ROUTINE FOR MOVE RIGHT
9215 INPUT D
9210 GOTO 10
```

and so on Unfortunately your input procedure has not taken into account the free format requirement of the input language and you can't see how to handle the labels Eventually it dawns on you that the easiest way is to codify each of the input commands into an array of numbers and you also notice that for the simple machine tool language only backwards jumps are allowed This simplifies things considerably

After a certain amount of effort you arrive at the program given in Fig 3 It is written in BASIC for a PDP 11/40 A description of its operation follows (see page 88)

a) Lines 8000 to 8095 form a subroutine to get the next word from the input stream All input is done by a call on the routine at 9000 so if it is required to input from a file or from the terminal only that routine need be altered The routine uses the function SEG to extract substrings of the input string A$ For other systems use LEFT$, MID$ RIGHT or whatever is appropriate e g

```
for 8050 B$=SEG (B$ 1 1)
8050 B$=RIGHT (B$ 1)
or 8050 B$=B$ (1,LEN(B$))
```

b) Lines 9000 to 9030 form a subroutine which gets the next line of input into A$ For some systems A$ must be dimensioned.
c) Lines 7000 to 7040 extract a number from the input stream, using the VAL function to return the value of a numeric string such as 3 2 or -3 5E0 1 Some systems loosen the requirement that the string is numeric and permit strings with a numeric left part Other systems do not have VAL and will require more tedious coding
d) Line 15 gets the next command word
e) Lines 20 to 98 perform a switch on the command word found
f) Lines 120 to 230 translate the input commands into the assembled code array C
g) Lines 500 to 520 flag any errors in command words
h) Lines 1000 to 1960 perform actions given in the code array C
i) Lines 2000 to 2020 increment the pointer

F to C for an argument function
J) Lines 3000 to 3020 and 4000 to 4020 increment the pointer P to C for one argument functions (see page 88)

Labels are handled by storing their code addresses in a table K which is accessible at run time No check is performed before running to see if a label exists but a jump to an undefined label will cause the program to stop Because this program was written in BASIC, there is no penalty in store in maintaining the table of labels during both the assembly and interpretation phases and it is reasonably easy to program For a more compact system the sizes of the code array C and the label array K can be reduced There is a slight speed disadvantage in handling labels this way but in the context of the machine tool great care must be taken not to drive the equipment too rapidly so this presents no problem Where it is essential to gain all the possible advantages of reduced speed and store the assembly phase must be modified to find the addresses of all the labels which can occur in any branching instructions and to generate code to cause direct branching during interpretation

You can of course modify the program in a number of useful ways to include such possibilities as calculating the distances to be moved by the tools sub routines for actions which occur frequently parameterised programs and subroutines which allow specification of the dimensions required during a run If your problem is not that of driving a machine tool you can still use the ideas in the program whilst supplying [illegible] actions and input language [illegible] to control your central heating [illegible] an emulator for a microprocessor system or a text editor or a word processing system The number of possibilities is considerable

Finally when you have done all this work the use of an interpreter gives another advantage In the years to come our manufacturer will return having bought a new computer to drive his machine tool which does not have BASIC

Basic

'I can employ an interpreter to translate my sentences as I speak them'

By now his investment in programs to drive his tool for different shaped pieces of metal is considerable He has over 5000 different programs and he is desperately worried about how he can get the new equipment working Should he scrap the existing programs and start again for unfortunately some of his most skilled machine tool operators who have written programs have gone to other jobs and it would be a considerable effort to modify the programs to suit a new programming scheme? Not at all! You assure him that you will write a new interpreter that will accept all the old programs not quite the easiest task you have ever tackled but orders of magnitude simpler than that of modifying and validating all of his working programs If he had opted to write his control programs in FORTRAN every one of the 5000 programs would have to be re-compiled before they could be used on the new equipment The advantages which can be gained by the use of interpretative techniques in the right place are considerable and portability must be one of the major ones

To sum up interpreters provide a simple way of implementing programs for performing relatively slow operations Frequently they provide advantages in the store requirements of the implementations and when used to implement a programming language allow the possibility of a degree of interaction which would be impossible to achieve by other techniques Because interpreters can be implemented simply the portability cost of transporting code from one environment to another may be lower than for other portability methods

References 1 Brown P J(1979) 'Writing Interactive Compilers and Interpreters' Wiley New York 2 Richards M(1971) The portability of the BCPL compiler 3 Software-Practice and Experience 1 2 pp 135-146

▶ To page 88

■ *The author is a lecturer in the Computer Science Department at Brunel University*

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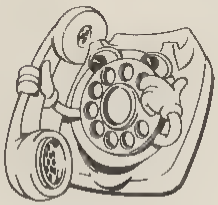

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PACKAGES

The Traditional Situation

Standard applications programs have been the goal of the computer industry from its outset Sadly in general we have fallen badly short of any satisfactory target

In principle the 'rules' of accountancy are clearly laid down and one sales ledger ought to be the same as any other In practice they simply are not, since they tend to reflect the nature of a company's business e g part payments back orders special discounts etc The accepted practices in any company have also built up over many years and have acquired their own flavour often exaggerated by mergers between companies In practice it should be possible to establish new simpler practices but there are real snags such as offending long-standing customers and the impracticality of creating a single pension scheme when employees of two previously separate companies have been paying to one scheme or another for years One company I know has nine different pension schemes to cope with On the other side companies who like to treat groups independently have further problems since while each may be treated separately overall data must be collated for group accounts

The ideal solution is obvious Specialist consultants can be employed to assess companies needs in depth, and to draw up a detailed *specification* Appropriate hardware and systems software can be selected and a software house commissioned to write install and test the programs to meet the specification This ideal is seldom practical however simply because of the cost This is exaggerated by the falling cost of hardware i e to pay £20 000 for software for a £30 000 box of hardware didn't seem too bad but while the hardware falls to £15 000 the software cost which is manpower dominated rises!

For the bigger systems say three and above terminals and over 10 Mbyte disc a compromise solution is usually the most effective In essence the software house constructs a system which in the main meets the specification by putting together existing software modules writing a specially tailored harness plus any more unusual but important extras

For many years the bigger computer manufacturers bureaux and software houses have attacked the problem by building software systems which include a large number of options In this way a much broader range of customer requirements can be satisfactorily met by inputting the appropriate parameters The problem however is that such complex software systems are large and relatively inefficient at run time they are also more successful in batch systems where the user can't see (and doesn't care about) slow response Thus they only work on big batch machines which well suit a bureau but have never been so well accepted on users' sites and have been very unsatisfactory on smaller machines Thus dissatisfaction is compounded by the fact that such packages provided by manufacturers still are not cheap and that any modifications (*always* needed in practice although not necessarily at day one) can be very expensive and inadequate since they have to obey the rules established in the rest of the programs

'The use of a high-level language such as COBOL or BASIC is a mandatory requirement'

Other companies have attempted to solve the problem of the run time inefficiencies and large program sizes of parameter driven packages by writing an extensive set of alternative modules These are maintained on a large computer with a special program which accepts the details of the user's requirements and generates a specific suite of programs from the modules These are smaller than parameter driven programs since they no longer contain the unused options There are few successful examples of this technique and some notable failures although I feel this was due to limitations in the then available technology I suspect a heavy investment in such a generator program could pay off today, particularly if the target code is interpreted so that it could be readily adapted to a range of machines

A classic situation is for a user to refuse to pay £20 000 for a tailored solution and to pay say £100 per month rental for a package representing a five year cost of only £6 000 The bad news however is that the user nearly always finishes up having to employ a programmer to continuously "patch" his programs adding £10 000 per annum to his bill compared to £1 000 p a maintenance costs to his software house Examples of failure to cost manpower requirements properly into the economics of computer systems are legion Another point on this topic is the impact of online processing This in fact means quite different systems design to that of a batch system so that attempts to add online routines to an existing batch system finished up with the worst of both worlds A good interactive operating system also means that the system is easier to run and can save at least one, and often more operational staff — systems are still sold (not to any of my clients!) which use punched cards for programming and operational control — be sure to cost in the extra manpower requirements

In order to protect investments few people will sell a package as anything other than executeable object code The high level source programs are retained by the vendor This is a major reason why packages are so expensive to modify The user can often purchase the source programs to attempt to free himself from ties to one software supplier but this can be very expensive With a tailored solution the user should be purchasing the rights to the source code from the outset

The use of a high level language such as COBOL or BASIC is a mandatory requirement for creating the source programs in any case assembly language coding is only acceptable these days for special applications e g data communications adaptors high speed process control systems Assembly language is most definitely a no no for commercial and similar work

All COBOL and many BASIC's are at least semi-compiled so that the vendor can retain control of the source However many microcomputer BASIC's do not precompile including the good versions so that all programs can be RUN LISTED EDITED etc The vendor thus cannot stop the user from gaining full access to any program Thus of course makes stealing of programs much easier and will cause considerable trouble in the near future Since most programs in this area will be relatively inexpensive, I must appeal to all users to actively attempt to stop this practice even to the extent of reporting such incidences to the software vendor Bank

rupt software suppliers are bad news for *everyone*

For years past Visible Record Computers (VRC s) have been the only small commercial machines on the market under £10 000 With limited processing power and online storage constrained to a few thousand characters per card performance is rather limited Because of these limitations application programs are simple and therefore cheap

Now with LSI (large scale integration) components reducing processor and memory costs and floppy discs providing online file stores of ¼ Mbyte and above, disc-based small business computers (SBC) now are cost-comparable with VRC s However to use the vastly increased potential of the SBC, *more complex* programs are required Can such software ever be cheap? This problem is further compounded by the growth of discette-based personal computers resulting in further falls in hardware costs and a much bigger potential market

Frankly, a properly devised suite of application programs would cost as much if not more than the hardware since as much manpower is required to complete an analysis for a small as for a big system Thus the only plausible solution is *standard off the shelf packages* where bulk sales can bring prices down to hundreds of pounds This can be a most satisfactory solution but only provided the 80 20 principle is accepted * There is precious little chance of any off-the shelf program meeting the individual user s total requirements at the price one must be prepared to compromise most work and fill in the rest by other means Certainly further programs and modifications can be commissioned to fill gaps but the cost of these will exceed the basic package

Without question the big problem lies in assessing the quality of any package offered It would be nice to say only buy it if other satisfied users can be found but the industry is too new for that! Probably the answer lies in the *quality of the documentation*

Some packages are written in Assembly Language in order to keep memory size requirement down Most are written in BASIC now that memory is relatively cheap A few are written in COBOL Modifications to the Assembly Language systems are almost impossible and I do not recommend them at all

Since the prices are low applications packages will often be sold only with a hardware package There may be some difficulties in buying an off-the-shelf package to run on any machine

Range of Packages

● *Commercial*

Stock control is one of the most popular packages for the newer smaller machines These are integrated with order processing and invoicing on the better ones Sales and Purchase Ledger programs are another area well served although beware

* *That is 80% programs for 20% of cost*

Overview

American developed systems The U S accountancy practices are very different to those used in the U K — there have been a lot of dissatisfied users of the basically U S packages sold by the bigger companies for these SBC s don t expect it to be any better for micros There are a few nominal ledger programs and simple pay roll routines (largely gross to-net only) Commercial systems on non disc based systems are hardly worth the trouble Spooling data to and from cassettes is not practical

● *Industrial*

There is a lot of interest but little progress on the industrial scene Obvious areas such as production scheduling bill of materials breakdown and shop floor data collection all have major difficulties and tend to differ very widely from factory to factory All this means difficulties for standard packages

● *Financial*

Most of the financial planning packages are for mainframes but this is an obvious target for micro packages This is an area where some progress can be made with small data files making the very cheap personal computers like the PET *quite viable* With high level languages like BASIC there are many financial planners who will write their own modelling programs

● *Statistical*

There are numerous statistical packages available for data analysis This area is also well covered in books of computer programs

● *Scientific and Engineering*

Special purpose packages for scientific and engineering design such as pipework layout matrix manipulation control system design etc are readily available but only for bigger computers They are often integrated with hardware features such as graphic displays FORTRAN is the common language used Computer aided design (CAD) is an obvious interest area for university research so we can expect a good range of packages to appear as the next generation of microprocessors provide high computing power at low cost

● *Time-Sharing Bureaux*

The computer bureaux have for a long time been an attractive source of packages for batch processing and sharing of resources The modern trend for high performance communicating terminals should lead to some highly satisfactory combinations of the simpler local use of packages backed up by mainframe batch processing printing and bulk storage

Special Software Products

● *Operating Systems*

Operating systems have traditionally been supplied by computer hardware vendors Indeed in the business computer world system software rather than hardware is the critical factor With the advent of the personal computer however a large number of companies have produced hardware packages which use a common source of system software namely Digital Research s CP M operating system and Microsoft Corp s BASIC interpreter and COBOL FORTRAN etc compilers Thus *system software* as opposed to applications programs are now available in packages Not that I am suggesting that anybody can take CP/M and run it on any system since the drivers have to be tailored to suit Once CP/M is mounted however there is much greater scope since any vendor supplying a compiler editor or whatever can make it CP/M compatible and sell it to a wide variety of users with different hardware

● *Database Query Languages and Report Generators*

Given an available operating system like CP M with a defined physical file structure there is scope for software houses to develop extended file structures to give more sophisticated file access Indexed sequential and other keyed file access techniques are supported and so are more general database packages These allow data items to be inserted amended displayed etc via simple interactive VDU commands There is a definite trend towards more "English like" language to ease the task of enquiring on a database and producing printed reports The simpler enquiry packages already available on micros are mostly "stand alone" and don t provide the ability to integrate the database from more conventional programs as do the bigger machine databases like TOTAL IMAGE etc Some however such as SEED are available

● *Word Processing*

The age of office automation is just around the corner The principle of using a VDU and discette as a glorified typewriter with editing and print formatting features is now well known Most word processing machines like the Wordplex Xerox etc are dedicated hardware/software packages However a microcomputer with a software package can, in some cases substitute and there are numerous examples on the market Frankly they are all toys since a real word processor needs a special daisywheel printer and a *very* high quality VDU It also requires a special compiled program which uses the more advanced VDU features such as line delete inverse video cursor control An interpreted BASIC program is just too slow Thus certainly use a cheap software package for playing with word processing but not for serious use

● *Data Entry and Data Communications*

Data entry and validation programs can be adequately written as applications programs in BASIC or COBOL A more specialised package along the lines of the REDIFON Seecheck system would be very useful

Communicating data between two machines requires special software at each end Communication between say a SBC and a mainframe computer takes place in most cases by emulation of an IBM 2780 RJE terminal using the Binary Synchronous communication protocol While this would require some special hardware to provide the synchronous I/O and modem

support 2780 emulation packages would be most helpful

Neither of these areas are served by off-the-shelf packages

● *Read-only Software — Firmware*

Strictly speaking, Firmware defines a set of read-only stored microcode routines which define the instruction set of a computer This of course is only applicable to machines which are designed on a micro coded basis and therefore excludes the fixed-instruction set micros like the 8080 In practice, it excludes minis like the PDP11, since while these are microcoded CPU's only DEC can get at the microcode memories — writing microcode is very specialised anyway There is however a trend towards committing regularly used routines into ROM as opposed to loading them into RAM at start-up time they still however reside in the address space of the computer memory, shared with other programs, and have instruction fetch overheads when executed They may possibly execute faster if higher speed ROM is used but the essential aim is to provide fixed versions of tried and tested software The best examples are committed system software routines The monitor PROM is an essential example followed by BASIC interpreters on the non-disc based system like the PET Frankly with disc based systems, I prefer the flexibility of loading a BASIC interpreter into RAM Some hardware systems feature 'phantom memories' which enable an executive function to execute in ROM, and then to switch some

Overview

RAM into the same address space to run an alternative routine

It is envisaged that applications programs will become so established that they will be marketed in ROM e g a sales ledger ROM We shall see Some of the commercial word processors are examples of an application program of a special nature committed to ROM Other examples are the ROM programs available as options on the more sophisticated calculators

● *Support for Packages*

The use of a package is decidedly cheaper than a special tailor written program The main reason for this however, is the elimination of the cost of manpower specifically providing direct services Thus the package user is far more vulnerable to lack of support The areas to watch are

- **Documentation Good application packages will be well documented Indeed this is as good a method as any of assessing a product.**
- **Installation Usually the product is supplied on a diskette However there will be considerable effort required to lay in data and to build files**
- **Training Training courses will seldom be available with simple packages Much depends upon the documentation**
- **Maintenance Software bugs do occur! Check that there is a route back to the programmer so that updates are available Be prepared to pay for updates.**

Applications packages are the only way for the small user to get into computerised accounting etc The solution is perfectly viable provided the purchaser accepts the 80/20 principle A £500 application suite will likely meet 80% of his needs, the 20% extra will cost £5 000 and more because the cost is no longer shared Do not attempt to squeeze 100% out of a vendor for £500 it will not work. Bankrupt software suppliers are bad news for everyone!

Packages are more problematic for the bigger SBC user with multi-terminals By definition such a user has more advanced requirements and as such is much more in need of professional advice A good software house using the modules approach can provide support analysis and programs but the cost will be in tens of thousands of pounds rather than hundreds Users starting with a simple single terminal diskette system and off the shelf applications programs must be prepared to expand upwards in both hardware and software costs

Beware the advice given by computer suppliers The examples of disastrous installations of packaged systems are legion not because packages are wrong but because their abilities and flexibility are grossly oversold There are still people foolishly buying VRC's bad though that may be I have even seen installations with more than one VRC totally unforgiveable on the part of both buyer and seller! ■

Professor Healey is at University College Cardiff

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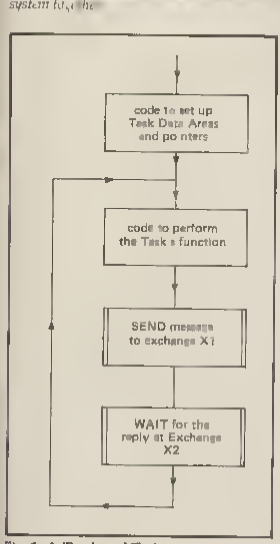
code to set up Task Data Areas and pointers
code to perform the Task's function
SEND message to exchange X1
WAIT for the reply at Exchange X2

Fig 1. A 'Producer' Task

This month we shall be looking at the mechanisms that can be used to control multi-user programs that are much more complex than the examples used in last month's article.

One of the first problems encountered when you start to look at the methods in actual use is that there are a number of competing terminologies in use which are used to describe mechanisms that appear to be similar but are used in different ways. For the sake of these mechanisms will be grouped according to their uses and their descriptions will be expanded as we see different uses made of them. In general there are two types of control structures: INTER TASK MESSAGE passing and the SEMAPHORE. We will look at each of these in turn.

Inter Task Message Passing

Before progressing any further we have to introduce three further concepts:

- **A MESSAGE is a single unit of information that is passed between Tasks/Activities**
- **An EXCHANGE is a pair of queues: one contains messages awaiting collection and the other to contain the identities of tasks awaiting messages**
- **A TASK is almost the same as an Activity. It is a Procedure (or Subroutine) that has its own data area and can execute independently. You will find that the terms are interchangeable.**

There is one major difference between the way in which a task hits into the system that we are about to look at and the way that an Activity of the type that we discussed last month fits into its environment. An Activity was shown as the dynamic part of a procedure: a set of data locations and a point of execution that traversed the code of the procedure. There was only one of these dynamic elements for each user of the system, but in this technique that we are looking at now, each task, each activity, has its own dynamic part. Every task is trying to execute its code all the time!

At any given moment in time, each of these tasks can be in one of three states.

The task whose instructions are actually being executed by the processor is said to be the ACTIVE or RUNNING task.

A READY task is one that is capable of running, the Active task is the Ready task with the highest priority. If you remember in the first article I said that you could give the Programs in a system an order of importance, referred to as its priority, well the same is true of tasks.

A Task is WAITING or DELAYED if it cannot run because it is waiting for a message.

The two basic operations required for this type of system are SEND and RECEIVE, they both operate on an exchange.

The SEND operation adds a pointer to the message onto the message queue at the Exchange. If there are no tasks waiting for messages at this exchange, then the task that issued the SEND request will carry on execution.

Should there be any tasks waiting for

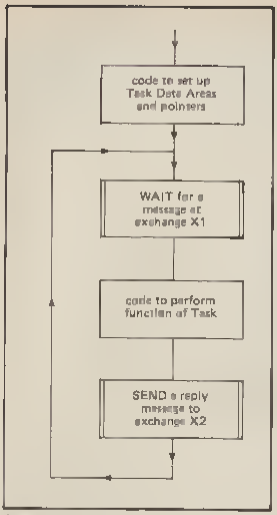

Fig 2 A 'Consumer' Task

messages when the SEND request is executed then quite a lot will happen. First of all the task at the front of the queue will be given the message and upgraded from WAITING to READY. Next the task that is currently ACTIVE is relegated to READY. Finally a SCHEDULER is called to decide which of the READY tasks has the highest priority and that task is then made ACTIVE.

The WAIT request has two forms: the unlimited wait and the timed wait. As you might guess from the name a timed wait fails if the task that issues it is not given a message within the time limit contained in the request while the untimed wait will wait forever unless a message is received.

Issue a wait on an exchange that has messages waiting for collection and straightaway you get given the message pointer from the top of the queue and you carry on executing. Should you issue a WAIT on an exchange that has no messages then your identity is put on the task queue associated with the exchange and your status reduced to WAITING. If the time limit runs out on a time WAIT then the task is given a message pointer with a value that indicates failure. It is upgraded to READY, the ACTIVE task is downgraded and the SCHEDULER called to decide which task to make ACTIVE. This allows programs to cause timed waits by issuing an WAIT on an exchange that receives no messages.

Of course having timed waits does imply that your computer has some means of counting the passing of time. This counter or Real-time clock as it is usually called communicates with the system by using an exchange which we shall call TICK. We have in the system a very high priority task called appropriately the CLOCK TASK which updates the system time and then goes round decrementing the counts for all the timed waits performing the failure processing described above if it is needed.

At startup of the system this task issues a WAIT request on TICK and after every pass it goes back to this WAIT. The Interrupt handler associated with the real time clock then only has to SEND a message to TICK every time it is entered and the CLOCK TASK will run. This same technique can be used to handle most devices that are running under interrupt. One important thing that I should point out is that this timed wait facility is easier to handle if exchanges are used for either kind of wait but not for both.

Now let us look at this exchange mechanism in action. Fig. 1 shows what is known as a PRODUCER task. Producer tasks are tasks that carry out their function and as a result produce a message which it sends to an exchange. The task will wait for a reply message at another exchange before looping back and going through the whole performance again. A CONSUMER task on the other hand will wait for a message at an exchange before doing anything. When it has performed its function it will send a message to another exchange and then it loops back to its wait.

the line printer. We designate an exchange to be the control point for this resource and at system startup a single message called a TOKEN is sent to this exchange. In order to gain control of the resource a task must issue a wait on the control point. Only one of the tasks queued at this exchange will be set to READY because there is only one message. When the task that received the message has finished using the resource it releases control by sending a message to the control-point. With there only ever being one message in existence at a time only one task can be using the resource. This type of control situation is termed MUTUAL EXCLUSION.

Now let us elaborate on this a little. Supposing we could arrange it so that the entries on the task identity queue were always sorted to be in priority order. Then we could call this exchange the Processor Control and the resource represented by the token would be the ability to have the task executed. This is in fact one of the ways in which the SCHEDULER could be implemented with all READY tasks being queued as a result of issuing a wait on this control-point.

The next use of the exchange that we should look at is SYNCHRONISATION. Here we are concerned with carrying out some function at set intervals. This might mean in a system monitoring a heating system scanning a series of temperature detectors every one second. We don't do this by having the scan task issue a one-second wait on an exchange that receives

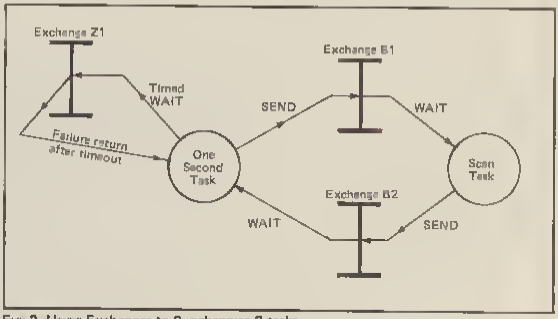

Fig 3 Using Exchanges to Synchronise 2 tasks

Actually, this sharp distinction between consumer and producer cannot usually be made in practice because normally the only genuine creators of messages are the input devices and even they start inputting as a result of a call from the system startup code. Most tasks consume and reply to messages as well as producing messages for another task to consume.

Let us now look at two examples of how exchanges may be used in the running of systems. The first use that we will look at is how to use an exchange to control a system resource that is wanted by a number of tasks. This resource could take the form of access to a common database or the use of some common device such as the disc or no messages instead we have an intermediate task the one second task that issues the wait. When the one second task which has a high priority is re-activated as a result of its wait being timed-out it sends a message to exchange B1 and then does another one-second wait on the NULL exchange (1). Apart from the very first time that it runs the one-second task will always wait on exchange B2 before sending to B1 (see Fig 3). The scan task will be waiting on exchange B1 and after receiving the message will read in all the temperatures do any sending of its own and then signal its completion to the one second job by sending a message to B2.

You are probably wondering why we

need this extra task the one second task, why can't the scan task issue the wait? The reason is that the wait will last one second after it is issued You will appreciate that the scan task will take time to read in all its values and that, as it may lose the use of the processor to a higher priority task for a period of time in the middle of its execution, the actual elapsed time that it takes will vary Therefore if the scan task itself

message having its buffer address set to the start of one of these units of memory All that a task would have to do if it needed one of these memory units to use as a buffer is to issue a wait on SPACE When the memory is no longer needed the task which now has it (for its original owner may have used it to send data to another task) needs only to send it back to SPACE

We will now leave the subject of the exchange mechanism and look instead at the semaphore and how it is used

The concept of the semaphore was introduced by W E Dijkstra in 1965 and is now probably the most popular of the control mechanisms used to control the sharing of resources in a system Basically the semaphore is an integer variable upon which two operations can be performed These operations we shall call PASS and SIGNAL or P and S for short although you are likely to find them referred to as I and V in some articles on the subject

The SIGNAL operation increases the value of the semaphore by one while the PASS decreases the value by one but not until this can be done without producing a negative result

It is normal to introduce the semaphore by showing how it is used to control the interaction between a CONSUMER task and a Producer task. Not wishing to break the tradition I shall also use this situation as my example

Let us create two semaphores called FULL and EMPTY a producer task called PTASK and a consumer called CTASK On startup FULL is a set to zero and EMPTY is set to one PTASK looks like this

```
PASS(EMPTY)
perform function
SIGNAL(FULL)
```

The consumer task is somewhat similar except that the semaphores are used in a different order

```
PASS(FULL)
perform function
SIGNAL(EMPTY)
```

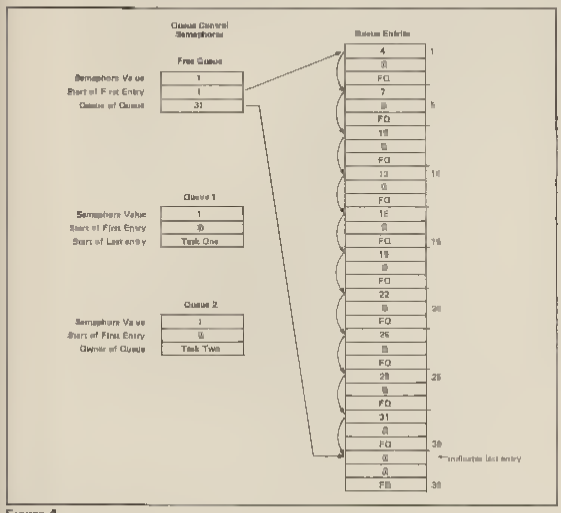

Figure 4

issues the one second wait it will actually be re-activated not one second but one second plus a variable time after it was last activated The one second task will always issue another wait at a small and constant time after it becomes active Thus means in effect, that the one second task will run at one-second intervals (plus a few micro seconds)

So far we have not said what is in a message put on the queue at the exchange Well, the message itself does *not* contain the data being passed Instead it consists of three pieces of information

- **The identity of the task that issued the SEND**
- **A count of the number of system-time units to wait before the wait fails (this is set to 0 for an untimed wait)**
- **The address of the buffer containing the actual data being sent.**

The buffer does not have to contain data, there need not even be a buffer!

Let us look at how the space in memory used by the tasks for storing data may be shared out according to need

First of all, the system startup routine would divide the space up into units of whatever size you have decided is the most practical for your system It would then send to an exchange which we call SPACE a whole series of messages each

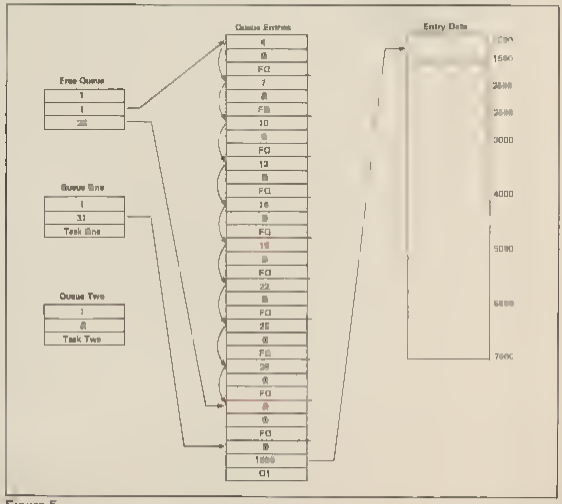

Figure 5

Let us look at the producer first. The PASS decrements EMPTY to zero. This is not negative, and so the task executes whatever function it has to perform and then SIGNALS the semaphore FULL before returning to the PASS at the start of the task. This time decrementing EMPTY would result in a minus one. As we said earlier, PASS will not be completed while this would result in a minus value, so the execution of the producer task is suspended and the scheduler will look for *another* task that can be executed instead. The SIGNAL on FULL will have increased its value from zero to 1 and so the scheduler should find that there is a consumer task that has been held up because it could not complete a PASS on FULL, which is now able to continue execution. This task will in its turn SIGNAL the EMPTY semaphore before trying to issue a PASS on FULL which will cause the scheduler to suspend its execution and free the producer task again.

This use of the semaphore could be elaborated a little by initialising the EMPTY semaphore to contain the number of free buffer blocks. This would allow the two tasks to run at different speeds, as the producer would not then have to wait for each message to be consumed before creating the next: a whole series of buffers could be filled before the PASS would cause the task to be suspended.

The semaphore can be made even more useful by giving it a queue. This is now a somewhat similar mechanism to an exchange. The two actions are now:

- **SIGNAL increases the semaphore by 1. If the result is not positive, then one of the tasks that has had its execution suspended by trying to PASS this semaphore is now released to continue when the scheduler allows.**
- **PASS reduces the value by one. If this produces a negative result, then the task issuing it is suspended.**

At this level the semaphore controls the execution of the tasks but does not provide a means of passing data between tasks. This is provided by setting up message queues, each one being controlled by a semaphore of the first type that we looked at, initialised to a value of one.

If a task has to claim this semaphore before being allowed to access the queue, then the initial value of one will prevent more than one task trying to change the queue at the same time. Fig 4 shows a way of implementing a queue that is equally applicable to both exchange and semaphore systems.

The HEADER (queue control semaphore) for a semaphore that is to be used by a task, in this case queues one and two, is three words long. The first word is the semaphore itself. This is the value that is incremented and decremented. The second word is a pointer that contains the address of the first queue entry on this queue. The third word will be the identity of the task that owns this queue, usually the task that takes entries off the queue.

As well as the queues used by the tasks there is also a queue that has all the unused queue entries on it. Initially all the queue entries will be on this queue and because this makes it a long queue, its header has a slightly different format. The third word contains not the owner identity for this queue, but the address of the last entry on the queue.

Now look at the queue entries themselves. These are three-word entries as well, having the following format:

- **Pointer to next entry on the queue. Zero indicates that this is the last entry on this queue.**
- **Pointer to the data for this queue entry.**
- **Identity of the queue.**

Fig 4 shows the initial state of the queue entries, with the entries all linked together to form the free-queue. Being on the free queue, none of these entries has any data and so the data pointer is set to zero.

Some people say that you should add entries to the front of a queue and take them off the bottom, and some say the opposite. Well, do whatever suits you, but be consistent.

The bottom of the queue is found by following down the links until an entry with a zero pointer is found. Most task queues will not be very long, so following the links should not take too much time. Where this method does prove time wasting is in the handling of the free queue, and this is why we keep pointers to both ends of the queue. There is of course nothing to stop you from keeping two pointers for each queue should you wish to do so.

Fig 5 shows the situation with a single entry on queue one, and Fig 6 shows the situation a bit later, when both queues have entries on them.

A task that receives data via a queue can pass it on to the next task that requires it by just un-linking the entry from its queue and linking it to the next task's queue.

These queues can be used as funnels into a real time system. With a funnelled system the input tasks for each of the terminals will place complete inputs onto the queue for the Switch task. This task then looks at the input, decides what processing it needs, and puts it on the appropriate queue. Each input contains the identity of the output queue for the terminal, and any reply messages are placed there.

There then is a brief look at Messages, Semaphores and Queues, and a few hints as to how they may be used to control a system that is trying to do a lot of things at the same time. But before finishing, let me just add a few things that apply to all these mechanisms.

The SEND, WAIT, SIGNAL, PASS and changing a queue are all CRITICAL REGIONS of a system. This is a way of saying that once one of these has started it *must be allowed* to continue without being blocked. This normally means that you have to disable all interrupts upon entry to a critical region and enable them again before exit.

Lastly, I have a simple suggestion for coping with Deadly Embrace (when two tasks are held up because each has one resource of a pair that they both require). Simply draw up a list of all the resources (and queues) in the system and then insist that any task that requires more than one at any time must claim them in the order that they appear on this list!

Think about why that should work. ■

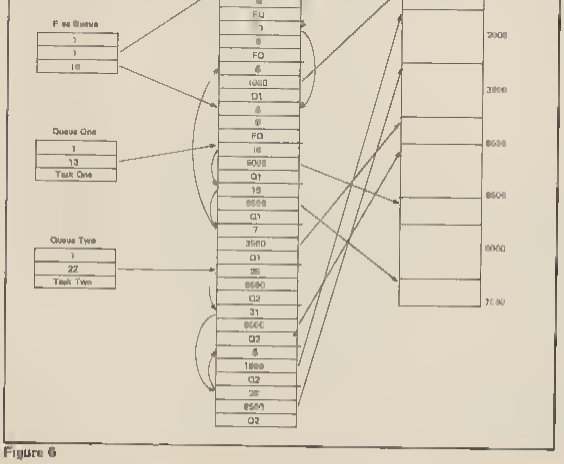

Figure 6

Bimonthly Series

TOP-DOWN

The third article in a series on programming techniques examines different approaches and points out the inherent obstacles in each of them

In my last article I looked at how a program can be split into a series of modules each of which can be programmed and tested independently of the rest. It is now time to look at how these modules are designed and how their relationships with each other are developed into the complete working program.

Before starting work on the program the programmer must be in possession of certain facts:

- a) He must have a clear idea of what the program is intended to achieve.
- b) He must know what input will need processing, and the information required in reports, output data for further processing etc.
- c) He must have a clear idea of the general algorithm or problem solving strategy to be used.

Only once he has worked out or been given this information is the programmer in a position to start work.

If the past a number of different approaches have been adopted at this point with varying degrees of success. Some of the most familiar are:

- Coding from the start of the program line-by-line. This is the way beginners usually attempt to write a program. It works, so long as the program is short and does not contain any long loops. Unfortunately long or complex programs are not like that.

  Very few programs are executed in the order in which they are written and no account is taken of those parts of the program which are most important. It is very tempting to spend a lot of time on the first few lines which may only be executed once and hurriedly put code together later in the program, which may be executed many hundreds of times. Altogether this is not a good approach to writing programs.
- Many a programmer starts work somewhere in the **middle** of the program usually at the point he thinks he understands and works out both up and down at the same time.

  After deciding on the general solution to the problem a rough sketch is produced often including specific

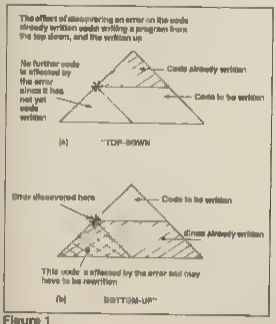
The effect of discovering an error on the code already written when writing a program from the top down, and the written up
No further code is affected by the error since it has not yet been written
Code already written
Code to be written
(a) "TOP-DOWN"
Error discovered here
Code to be written
Errors already written
This code is affected by the error and may have to be rewritten
(b) "BOTTOM-UP"

Figure 1

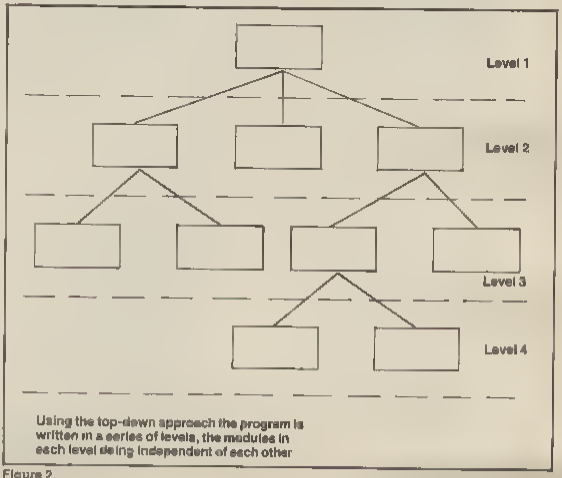
Level 1
Level 2
Level 3
Level 4
Using the top-down approach the program is written in a series of levels, the modules in each level being independent of each other

Figure 2

code the "important" parts. Since documentation is often considered unimportant this is left to later and it is hoped that the code produced will not require drastic revision before the final version is obtained. A complete first version is then coded and successively revised until the final program slowly emerges. The revisions often include drastic rewrites and so considerable effort is wasted in writing code which will never appear in the final version. Also no thought is given to the most important parts of the program on which all depends.

- Some programmers spend considerable time in analyzing the **flow of control**, producing detailed flowcharts etc., to show exactly how the program is to generate its final result. This is a method which has been used effectively for many years to produce the large program suites which are in use every day on large computers. The overall flowchart is used to break down the problem into a number of modules, which are then tackled individually. Once all the modules are complete they are put together and the interfaces are firmed up to make everything work properly. The problem is that the program is designed round the flow of control rather than its *underlying physical structure*, which may not have been understood completely. Also the subsidiary modules receive attention before their interfaces (and therefore their complete function) has been defined.

- The **bottom up** approach has some adherents particularly among assembler-level programmers who are intimately involved with the hardware of their machines. Here the lowest levels are written first and work progresses to successively higher levels until the complete program emerges. Despite its attractions to the programmer who feels seriously constrained by the underlying hardware of the computer, this approach suffers from a number of serious defects. Specific decisions on how to implement various parts of the program must be made before the overall structure is completely understood. Notably the interfaces between modules are defined before it is possible to say exactly how these modules are to be used in the final program. The constraints imposed at low level often to overcome supposed potential problems are reflected right up through the program, and may make the higher levels much more complicated than is strictly necessary.

- The **top-down** approach, on the other hand requires that the programmer deals with the overall specification and organisation first before proceeding to the details.

Figure 1 shows how an error in the

Algorithmic Design

high-level design can affect very large sections of code when the bottom up approach is adopted. This is a considerable wasted effort since much of the code may have to be rewritten.

With the top-down approach the error can be detected and dealt with comparatively easily since none of the subsidiary code has yet been produced. The programmer can then proceed to lower levels with reasonable confidence that those already completed are correct.

- The basic principles of the "**top-down**" approach are

a) *Design the program in levels*

The program should be designed as a series of levels, each of which should include one or more modules. A module should always be complete, although it may call as yet unwritten modules at a lower level. Each successive level refines or develops the program further. The programmer may have to look several modules ahead to discover the best way of organising the modules required in the completed program and to design the module in hand.

b) *Initial language independence*

The first description of the program is usually written in such a way as to relate to the problem in hand (it is often written in English) even though this cannot be translated directly in code. From this initial design the final machine code is produced.

c) *Postponement of details to lower levels*

The programmer concentrates on the broad issues at the higher levels and postpones decisions on such things as the exact algorithm used and the storage of intermediate data to the lower levels. Should it be necessary to change the exact method of calculation at a later stage, this can be done without affecting the basic structure of the program.

d) *Defining the interface with lower levels*

At each level it is necessary to define completely the interface to all the sub-modules called together with their necessary parameters. This, in turn, becomes the specification to be met when the sub-module is eventually designed and written. This step ensures that further sections of the program can be written independently, without the need to change the interfaces again later.

e) *Verification of each level as it is written*

Each level is verified before going on to the next, thus ensuring that errors are detected at the earliest possible stage before their effect can be spread through a series of sub-modules. Thus allows corrective action to be taken quickly at little cost since the alterations required are likely to be few and very localised.

f) *Successive refinements*

As each level is defined in detail the programmer works from the higher levels of program organisation down to the detailed problems of implementation. Each level is verified on its own until

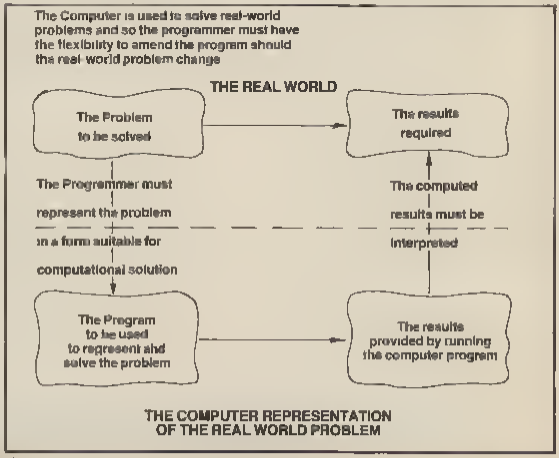
The Computer is used to solve real-world problems and so the programmer must have the flexibility to amend the program should the real world problem change
THE REAL WORLD
The Problem to be solved
The results required
The Programmer must represent the problem in a form suitable for computational solution
The computed results must be interpreted
The Program to be used to represent and solve the problem
The results provided by running the computer program
THE COMPUTER REPRESENTATION OF THE REAL WORLD PROBLEM

Figure 3

the program is complete and can be translated easily into code

Using the top-down approach the program is written in a series of levels, the modules in each level being independent of each other

It is often forgotten that the program is simply a representation of a real life problem. Data must be extracted which is then fed in for computational solution and the results must be interpreted to see how they relate to the problem in hand (see figure 3). Should the problem the program is expected to solve change the program should have a flexibility to *change with it*. It would be pointless for instance, to write a sales analysis program which required considerable rewriting should a salesman leave, or extra items be added to the product lists. These possibilities should be considered at an early stage in the design of the program and allowed for.

It is not always possible to see exactly what changes will be required during the life of the program. It is usually possible however to identify the areas where amendment is most likely, and to place these in the lower levels. It is then possible to amend, or even totally rewrite modules without disturbing the main body of the program. Maintaining a program does not just include the fixing of bugs which may be found from time to time, but *revising* it to maintain its usefulness over an often considerable period by amending it to take account of the changing environment. Whole modules may be stripped out and replaced if necessary without disturbing higher levels, or even modules at the same level.

But can the top-down approach be used when programming in BASIC and ASSEMBLER? The answer is of course yes. The higher levels must be written in a high-level language (how about English?). Once the design is complete it is then translated into the final machine readable code. The original design should be kept safely as it will be required to maintain the program later. Comments should say how the logical control structures have been implemented, and how parameters are passed between modules. Subroutines should be used whenever possible to break up long blocks of code and to represent the modular structure of the design. Most programmers have their own standard ways of doing this which makes the final program easier to follow.

It is essential not to fall into the trap of designing the program linearly encouraged by the line-numbering conventions. It is never possible to guess how many lines of code will eventually be needed for any particular module so a *renumber* facility is a must. It is unfortunate that so few microcomputer BASICS provide this facility but utility programs which reside in the memory together with BASIC are now available for most popular machines. ■

Computer Age

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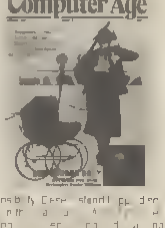

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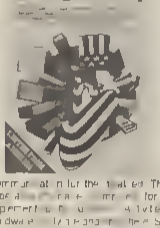

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DEMONSTRATION ONE

Newcomers to our magazine can refer to the introduction to FORTH which appeared in Issues one to four

This is the first of 'Statdist demos It is a short programme for displaying a negative exponential distribution A random number programme shows how code may be written Into the dictionary by use of C to enter a single byte and ', to enter a two-byte instruction The Forth word definition starts with a colon as usual and is then followed by ,CODE , after which follows the set of code instructions The word so defined must be invoked once before anything else is entered. After that invoking the defined word executes the code This random number generator adds 13 bytes to give the 14th Thareafter cycling on the Y index In the Statdist commands the word INIT sets up the speeds Random' generates the number And RPR puts it on the stack The NEGEX' programme contains explanatory notes in brackets which the compiler ignores 20000 is chosen for the end condition since it gives a reasonable format on the Apple screen The success rate is about one in 5 if T is made 200 so some 100000 random numbers are used for the demo When dividing by 'A as a scale factor the result is rounded even though this is a bit frivolous, just to show how it is done The remainder is doubled and compared with 'A The Begin End' construction needs explanation. It sets up an indefinite loop which carries on while End sees zero on top of the stack It will stop when the '20000 comparison is true

Now as a small exercise in FORTH, write a programme using BEGIN END to find the highest common factor of two numbers The best algorithm is due to Euclid in which the smaller is subtracted from the larger The result and the smaller of the two are used as the next pair ■

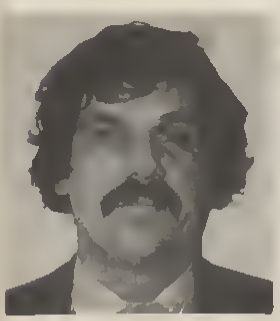
•Gil Filbey is a lecturer in Physics at the Polytechnic of the South Bank, London

```
( SCREEN 2  PROGRAMME FOR SHOWING STAT
ISTICAL DISTRIBUTIONS. )
          ********************
0  VARIABLE T ( IN ALL DEMOS <255-T>*256
  IS THE SUCCESS PROBABILITY )
1 VARIABLE Z ( ASSIGNS THE NUMBER OF
  BOES IN THE POISSON DEMO )
2 VARIABLE X 300 ALLOT ( ALLOTS 250
  LOCATIONS FOR AN ARRAY X )
3 VARIABLE A ( USED TO INDEX X )
  ZERO ( FILLS X WITH ZEROS ) 250 0 DO
  0 X I DUP + + ! LOOP ;
: START ( SETS UP POISSON DEMO ) INIT
  ZERO A ! HOR2 ; ( USE'N START' N IS
  STORED IN A )
: INC 1 SWAP +  ,     A INC ' INCREMENTS
  A )
  /N ( SELECTS ELEMENT X<R>  % A C@
  DUP + + ,
  MINE ( EXPECTED NO  OF SUCCESSES IN R
  BOES ) 256 Z @ *  256 SWAP - T  ,
  ( REVERSE POLISH MIND' )  ;S
```

```
( SCREEN 4  RANDOM NUMBER GENERATOR
ADDS 80 BYTES AND STORES  SUM IN 8,9.
Y RUNS ROUND THE SET OF BYTES  THE
RESULT IS STORED IN $7300 )

  RANDOM ,CODE 18S ,  89  ,  7F  ,  65 ,  5
65 ,  65S ,  7D5 ,  8D5 ,  4F  ,  8D5 ,  8D5

  D5 ,  D5 ,  AC C,  7300    98 C,  C ,
    $7F  ,
88 C,  5F8 ,  8C C,  7300 ,  B0 C,  8    4C C
  281F ,  8DF8 ,  8C C,  7300 ,  4C  ,  281F ,
```

```
( SCREEN 5  STATDIST PROGRAMME )
( ********************** )

: NEGEX
  BEGIN 230 0
    DO
      RANDOM RPR          ( GETS RANDOM NO
      T @ >                 ( SUCCESSFUL?)
      IF                    ( SUCCESSFUL)
        X I DUP + + INC (  INC ITH ELEMENT)
        I  X I DUP + + @    ( GET IT )
        A C@ /MOD  ( DECIDE SAMPLE SIZE )
        SWAP DUP + A C@ >     ( ROUND IT )
          IF                    ( TRUE?)
            I+                  ( TRUE )
          THEN              ( JUMP HERE IF FALSE)
        PLOT LEAVE      ( PLOT & SET OUT)
        THEN 5  ( JUMP HERE IF NO SUCCESS)
      +LOOP                 ( AND TRY AGAIN)
      1+ DUP 20000 >        ( BACK TO BEGIN )
  END DROP ,  ( OR STOP & DROP COUNTER)
;S
```

IVERSON'S LANGUAGE



The greatest barrier to learning APL is its 'strange' notation. But as Alan Pearman says, the potential APLer takes that part of the language that he needs, and disregards the rest. This way, it is possible to become familiar with an extraordinarily powerful and compact language, part of a new wave sweeping over micro land.

APL History and Implementations

APL (A Programming Language) was developed by K E Iverson and others during the 1960's but was not available generally until 1968/69 when it was distributed free of charge (!) by IBM Research Centre to several companies. Two of these companies — I P Sharp Associates and Scientific Time Sharing — are still prominent in the field of APL.

APL is, currently, among the fastest growing high level computer languages if only due to the fact that it started from such a small base. One or two years ago, hardly anybody of my acquaintance had heard of APL, now virtually everybody I meet from the computer field has not only heard of it but knows that it is different in some important way from other computer languages.

From the original APL developed under IBM's banner (APL/360) there have grown many other implementations, apart from I P Sharp and S T S (APL Plus*) there is Xerox APL on Sigma machines, DEC-10 (APLSF), Burroughs and many others ▶

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APL Series

Recently ICL has launched its own APL (APL/B)

There are now APL implementations on minicomputers and micros on a mini GEC's new version is noteworthy On a micro most of the implementations so far use the Z 80 chip our company has marketed Vanguard Corporations APL/V80 for almost a year This is a powerful but not quite complete implementation of APL Additionally available are TIS/APL which can be made to run on any Z80 machine with at least ca 36k bytes, and an APL version from Softronics which has an 8085 version in addition to the Z80 version

All reasonable micro APL implementations occupy at least 28k bytes of memory and a working area of 10K bytes or so is a probable minimum for most applications

Features of APL

APL as a language is remarkably uniform Whilst new standards are imminent there has hitherto been none and the probable reasons for the uniformity are that it was developed in the first place by such a small group of individuals and because the basic operations (called primitives) of the language are so natural Deviations from the de-facto standard are restrictions rather than definitional differences in the case of microcomputer implementations and isolated additions using new symbols in the few cases where mainframe versions differ There are strong indications that all mainframe versions will fall in line when the standards committee meets later this year

APL is what Kenneth Iverson terms *separable* This means that the potential APLer takes that part of the language that he needs, and disregards the rest

An obvious feature of APL is that it has a special character set Here are some of the characters

A B C D E F G H I J K L M N O

α ⊥ ∩ ⌊ ∈ _ ∇ Δ ∘ ' ⎕ | ⊤ ○

P Q R S T U V W X Y Z < ≤ = ≥ >

* ? ρ ⌈ ~ + ∪ ω ⊃ ↑ ⊂ ⍉ ⍒ ⍋ ⌽

This is actually a fairly unimportant difference and as will be seen, you can do without it

APL is interpretive like most BASIC implementations This means that each line of coding is executed as it is encountered and is thus likely to be longer in the machine than a compiled language such as Fortran or Pascal However you will see that APL handles lists and tables arrays as easily as it handles single values Consequently one line of APL code needs more than one line in other languages — it could be dozens — and looping is used infrequently in APL APL is as fast as an interpretive language can be and there are

of course a number of primitive features of an interpretive language

APL Applications

Many people consider APL to be a mathematician's language and draw the wrong conclusion that it is not meant for them Indeed I thoughtlessly mentioned the word matrix to one potential APLer which made my consequent exposition far harder than it need have been

APL is mathematical in the best sense which is really saying that as many need less restrictions as possible are discarded However oddly enough most APL applications are not mathematical and most APL practioners in my experience are not mathematicians (APL in fact is probably at its weakest in traditional numerical analysis but this may change)

I have before me a book An APL Users Meeting published by I P Sharp The contents cover the following subjects

- **Financial Planning**
- **Calculus**
- **Computer Science**
- **Architecture of Crystals**
- **Actuarial**
- **Graphics**
- **Networks**
- **Banking applications**
- **Statistical techniques**

APL is well suited to all of these topics and many others It is in fact difficult to think of application areas where APL is not useful, these are probably confined to such topics as real time control where fast responses are needed and where no high level language is suitable

Learning APL on a micro

Learning APL is a question of practice – no amount of reading will teach you APL satisfactorily

APL is easy to learn because you need only know the necessary operators for a particular application the rest can be disregarded For example, to get the larger of two numbers you enter

```
      3.5⌈6.7
6.7
```

The symbol ⌈ called maximum is all you need to solve a certain class of problem You therefore concentrate on a small class of primitive operators — as symbols like ⌈ are called — and practise them until you gain familiarity with them

This text used correctly will enable you to learn APL in 10 20 hours practice spread over a week or two By learn APL we mean

You will be able to solve problems in your own field of competence using a subset of the primitives

You will have an understanding of the scope and structure of APL

You will be able to tackle other APL texts for further learning

You should adhere to the following method in order to get the most from this course

- Read the text actively Test each result using your own microcomputer
- If you do not understand a result try some related examples Do not be too concerned however if you cannot grasp it understanding will come
- Attempt every example set Write down your anticipated solution before getting APL to solve it
- APL can be learned quickly but you should not try to learn it too fast Certainly do not attempt a compendious detailed knowledge of all the primitives without attaching realistic examples to them Devise as many examples as you can from your own specialism There are some primitives that you may never use — why learn them?

Micro equipment needed

The following equipment is needed

- **A Z-80 CP/M system with a minimum memory of 48K bytes, and one floppy disc drive 5 ¼" or 8" The MAPLE microcomputer system is a suitable system**
- **A VDU or hardcopy terminal An APL terminal is not essential — indeed this text specifically allows for this possibility**
- **A copy of APL/V80**
- **A copy of CP/M operating system**

The APL Character Set and ASCII Equivalents

Much is made of the fact that APL has a special character set and cynics may be forgiven for thinking that it is a plot by hardware manufacturers to increase sales This is not, however the case nobody disputes the usage of symbols such as + in their place — though you could conceivably write plus and minus — and APL simply extends this usage

The very best way to show that APL symbols are preferable is to do without them this is quite possible and you will discover the power of APL whatever character set you may use Eventually however you will probably find that an APL terminal is more convenient

In this course, standard APL notation is used, and the ASCII equivalents are written in the foot of each page In this way you will think and write in terms of APL notation even if you key in ASCII mnemonics The large volume of APL material which is invariably written in standard notation will thus be accessible to you

Loading APL

First load CP/M into memory then insert your APL disc (You may find it con

APL/ASCII: ⌈↔*S* APL/ASCII: ⌽↔reverse APL/ASCII:)*WSID*↔)wsid;)*LIB*↔)lib;)*SAVE*↔)save

vement to copy APL onto your system disc) You will find the following programs as well as others which need not concern us at this stage

APLV80 COM
APLASC COM

If you are going to use the ASCII symbols type

APLASC <return>

otherwise, key in

APLV80 <return>

You will now hear APL (32K bytes) being loaded into memory, which takes about 10 seconds on an 8" system somewhat longer using a minifloppy You will then get a prompt

APL Series

During the course we will [illegible] you will enter a line (by [illegible] the line and conclude with a carriage return — as soon as APL detects a carriage return it begins to execute your input Now try the above session yourself — don't forget to type lower case alphabetics if you have a standard terminal We remind you that the ASCII equivalents are at the foot of each page Don't concern yourself at this stage on what any of this means as the purpose of this preliminary exercise is simply to enable you to get the hang of the dialogue concept in APL

Alan Pearman with MAPLE

mmddyy- (ASCII version)
MMDDYY (APL version)

Enter the date in the appropriate form eg 20th September 1979 should be entered thus

092079

It is preferable to put in the correct date even though eg 090909 works
You are now in APL

Communicating with APL

APL indicates its readiness to receive information from the keyboard by typing 6 spaces responses from APL begin at the left margin A dialogue with APL looks something like this

```
      2+4
6
      ⍳9
1 2 3 4 5 6 7 8 9
      'FRED'
FRED
```

One other point: do not be afraid of experimenting If an idea or puzzling point occurs to you just enter it

Interrupts

If, instead of typing ⍳9 as above, you typed ⍳1000, then the computer will be occupied for some seconds typing out the integers from 1 to 1000 Thus it is useful to be able to interrupt APL on occasion This is achieved by pressing the escape key Try it

Line Editing

If you key in the wrong character you can correct it rather than reenter the entire line again In Appendix A the procedures for line editing are given These vary slightly depending on whether you are using the serial version of APL In both cases there are two circumstances where line editing can be used

* where the error is detected before the line is entered
* where the line has already been entered

Overstrikes

Some APL characters are actually three keystrokes the second being backspace For example

```
      ⌽1 2 3 4
  4 3 2 1
```

reverses a list The character is formed by typing o (shift-O) backspace and | (shift M) This distinction is irrelevant when the ASCII set is used

System Commands

APL is done in the context of a workspace This is a named area on disc a copy of which can be loaded into memory by means of a system command System commands are a means of communicating with the system and are distinguished from other APL objects in that they begin with a right (closing) parenthesis For example, type

)WSID

ASCII is the name of the active workspace While you are using this text, you should generally be in this workspace because the special ASCII equivalents are saved therein WSID is a mnemonic for 'workspace identification' If you happen to misspell a system command APL will respond with

INCORRECT COMMAND

Simply retype the correct command
The system command

)LIB

```
WSFNS
TRIGENS
ASCII
```

returns a list of all workspaces on the current disc This provides a convenient means of keeping track of your workspaces

While you are communicating with APL none of your work is written onto disc so that if there were a power failure or any malfunction of the system it would be lost To write a permanent copy onto disc you type

)SAVE

and to retrieve a workspace

)LOAD (WS name)

is entered Loading a workspace destroys any information in the current working area

To rename a workspace, the command)WSID is used as follows

)WSID (new name)

Permissible names for workspaces comprise alphabetic characters and digits only and the loading character must be alphabetic

To get off APL simply type

)OFF

Security Copies

You should at this point take a copy of

APL/ASCII: ⍳↔I; 'FRED'↔'fred' APL/ASCII:)*SAVE*↔)save; *DISKA*↔diskA)*WSID*↔)wsid;)*OFF*↔)off;)*LOAD*↔)load; *DISKB*↔diskb

the workspace ASCII This Is achieved by typing as follows

```
)WSID
ASCII
```

This checks that you have the correct workspace If not you enter

```
)LOAD ASCII
SAVED 12/30/79
```

Now put a blank discette into drive B and type

```
DISCB
```

DISCB is a special instruction in the ASCII workspace The indicator light for disc B will illuminate (If you have a single drive the message LOAD B will appear insert a new diskette and press return)

Now type

```
)SAVE
```

and a copy of ASCII will be written onto your backup disc You return to disc A by entering

```
DISCA
```

System Variables and Syetem Functions

As well as system commands APL communicates with APL via system variables and system functions The following actions, among others, are achieved using these APL objects

- control the print width,
- inform you of how much space you have in your active area;
- enable input and output to be diverted to a printer;
- specify active disc unit
- list the normal objects in your active area

Errora

Enter

```
      3+A
VALUE ERROR
      3+A
        ^
```

APL informs you that you have made an error In this case, the variable A hasn t a value (Variables are discussed in the next article) There are a dozen or so possible error reports, and APL points to where the error has been discovered in the manner indicated above on being informed of your error, you may rectify it by either retyping the offending line, as in Appendix A

Negative Numbers

APL distinguishes between subtraction, eg enter

```
      7-3
4
```

APL Series

and a negative number e g enter

```
      3-7
    ¯4
```

The symbol preceding 4 is called high minus and is an attribute of 4 (telling us that it is negative) The usual minus sign is reserved for subtraction so that for example, enter

```
      3-¯7
10
      ¯3-¯7
4
```

These are both possible and reasonable operations But enter

```
      3¯7
SYNTAX ERROR
      ¯7
      ^
```

This is meaningless to APL

Exercises

1 Enter the following APL expressions

```
      3+8+5
16
      3x6
18
      8 7 6
1 5 5 4 3 2
```

2 Type but do not enter

```
      1 2 3 XYZ 5
```

Now correct this to read (see Appendix A)

```
      1 2 3 4 5
```

and enter it

Now enter

```
      1 2 3 XYZ 5
```

You will get an error message Recall the line (Appendix A) and correct it as before

3 Find the name of your active workspace — it should be ASCII Now list all workspaces on the active disc

```
Rename ASCII to NEWNAME
List the library Is NEWNAME there?
Save the active workspace Is NEWNAME in the library?
There is a system command )DROP
Enter )DROP NEWNAME and list the library Is NEWNAME in the library?
```

4 Enter

```
      1000⍴1
```

Interrupt the result

Appendix A: Line Editing

There are two APL/V80 versions video and serial which differ only in line editing and error correcting There follow details on these methods

APL/V80 Line-editing Video Version

1 Editing before the line is entered
There are four cursor control codes available

Keystroke	Action
Control-L	Moves cursor to the left one position
Control-H	Moves CURSOR to the right one position
Control-J	Deletes CHARACTER to the right of the cursor
Control-K	Moves CHARACTERS to the right of the cursor

(Control codes are entered by depressing CONTROL and the appropriate key together

Exercise Using the above control functions type the following line (but do not enter it)

```
'THIS IS INERT'__  cursor is here
```

Now change it to

```
'THIS IS AN INSERT'
```

and enter it

2 Editing after the line is entered
Depress DELETE (RUB on some keyboards) and the last line entered is recalled with the cursor positioned at the end of the line Editing is now performed as above

Exercise
As above but enter and recall and edit

```
'THIS IS INERT'
```

3 Aborting a line
Pressing ESCAPE aborts the current line

APL/V80 LINE-EDITING SERIAL VERSION

1 Editing before the line is entered
Press BACKSPACE until the error is reached Now press LINEFEED (not carriage return) The line may now be re entered from the point of the error

For example

```
THIS IS INERT,  ←Type-element or cursor is here
```

Backspace

```
'THIS IS ^ INERT'
          Type-element is here
```

Line-feed

```
'THIS IS ^
        AN INSERT'
```

(Resume typing and enter)

2 Editing after the line is entered
(i) Press DELETE (or RUBOUT) The last line entered is typed out and the type element or cursor is placed at the beginning of the next line
(ii) Place a slash character ( ) beneath any character to be deleted and a back slash (\) beneath any character BEFORE WHICH an insert is desired
(iii) Press RETURN If there are only deletions the correct line is entered If there are one or more insertions to be made the line up to the first required position is typed by APL
(iv) Enter desired insertion Press CONTROL D APL will continue typing until the next desired insertion position is reached or it will enter the line if there are no further amendments to be made
3 Aborting the input line

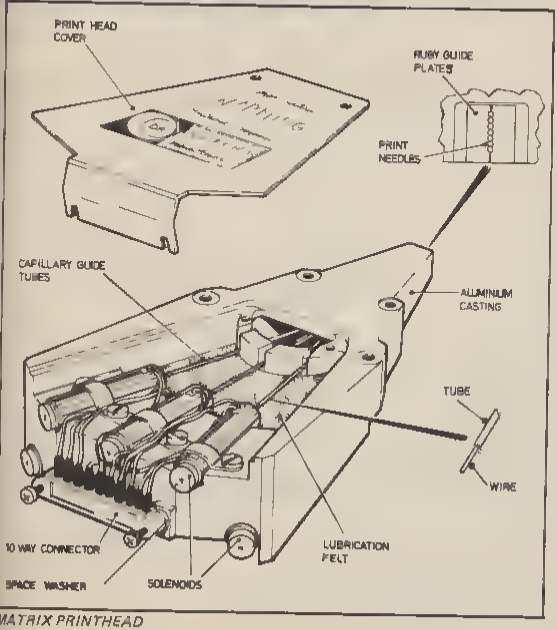
Press ESCAPE ■

Alan Pearman attended Sussex and Dundee Universities where he obtained a Master s degree and PhD in Electromagnetic Theory Since then he has added Fellow of the Institute of Statisticians and Fellow of the Institute of Mathematics and its Application to his list of achievements After a career in defence work and industrial R&D as a consultant mathematician/statistician he started his own company A P Ltd (Alan Pearman Ltd) which has grown up out of increased involvement in APL software writing and the marketing of the MAPLE A P Ltd s own purpose-designed micro APL system

APL/ASCII: A↔a APL/ASCII: ¬↔~ APL/ASCII: XYZ↔xyz;)DROP↔)drop; ⍴↔reshape

Joe Hemani is a senior sales and applications engineer with [illegible] Recording Equipment with special responsibilities for terminal products. His background is in facsimile transmission and keyboard development.

MAKING MARKS ON PAPER



MATRIX PRINTHEAD

The microprocessor has affected our everyday life [illegible] that to be a dramatic statement. In fact in the near future it will be part and parcel of four everyday life — that in itself explains the flexibility of microprocessors. Today's matrix printers based on the micro offer a variety of user options, operating flexibility and reliability coupled with printing speeds from 30cps to 600cps.

Unlike line printers using fixed arrangements of characters formed on drum chain or charband, the dot matrix system makes character shapes from a series of dots. The combination of dots which make up the character varies from 7 x 7 to N x 12.

A great advantage of this printing technique is that character sets can be easily changed electronically and can also be under software control. Special characters or scientific symbols present no problem provided the pattern can be formed by the matrix of dots. Because the printing process lends itself to electronic control it has become viable to include a microprocessor controller in the printer. Now we can build in a degree of intelligence within the terminal such as additional forms control and

[illegible] the paper [illegible] trol [illegible] terminal. Ex[illegible] and self diagnostic [illegible] ming standard featu[illegible]

Thus the mat[illegible] printer a versatile tool in today's [illegible]

Let's examine briefly some additional features. Compressed, elongated or double height characters to be used as headers, dual ink facility, plug in character ROMs which offer a wide selection of national character variants. Individual pin addressability for graphics or true below the line descenders, tractors to facilitate handling of different sizes of computer stationery.

Matrix printhead design has been radically improved in the past year. DRE with their new generation of printers offer head life of up to 400 million characters. As the head design has improved so has the print speed, thus overcoming problems associated with heat, pin retract and fire solenoid and needle firing resonance, and several other intricate mechanical problems.

Basically this is how it works. A vertical row of, say, seven print wires, activated by solenoids, forms the basis of the printhead mechanism. It was common with early design to arrange the solenoids in a single horizontal plane, but because of the severe bending on the extreme print wires, this has been discarded by several manufacturers in favour of a radial arrangement, thus reducing the bend radius and frictional forces, resulting in a more reliable and faster print mechanism. When printing impulses are received the solenoids are selectively energised to drive the wires against the inked ribbon, paper and platen to form the first vertical row of dots in the construction of the character. The head is then stepped along to the remaining columns to form the complete character. The force and energy of the fired needle is sufficiently strong to produce an original plus four or five carbon copies. Paper is moved either by a tractor mechanism or friction feed, for the next line of print. Centronics have made available an 18 x 9 matrix print head using a free flight head, which creates characters within a standard matrix size but packed with 18 possible horizontal dot placements. More dots mean higher resolution — we have thus reached a stage where matrix printers will be making inroads into the solid character printer market for word processing applications.

The matrix printer has come a long way from the days when friction clutches and heavy springs were employed as end stops. Today the mechanical element has been considerably reduced to enhance reliability. Thus most forms of mechanical switches (micro switches etc.) have been replaced with photo cell transducers for character positioning, margin sensing, ribbon end or direction, in fact anywhere where one needs to detect mechanical movement.

Basically there are two methods of connecting a printer to the outside world (computers, VDUs etc.). One is serial and the other parallel transmission.

Serial transmission can best be described as a single pipeline where one bit at a time is sent down the line. Serial forms of data transmission fall into three common categories: open collector for local use 20m a current loop and finally the RS232 (V.24) type of serial transmission. With the V.24 transmission one can use modems and distance is not rendered a problem. Most serial printers have in line buffer capabilities and can handle data transmission rates of between 75 and 9600 baud. Once again printers have the capabilities of responding to various protocols and control conditions — so that data can be transmitted and received either synchronously or asynchronously to avoid data corruption.

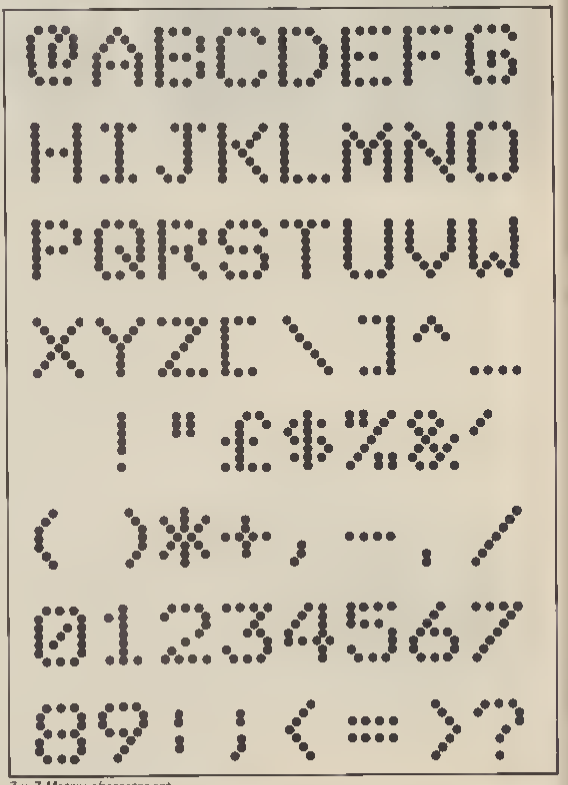
Centronics have set a standard as regards *parallel* data transmission. In parallel transmission all the bits (byte parallel) are transmitted simultaneously. Thus the connection from the computer to the printer is hard wired with eight data bits. Once again there are extra lines available for some control features, such as "paper out", "printer busy" etc.

The new technologies in producing printers with a variety of characteristics have emphasised how the advances have affected cost, design, performance and reliability. The emergence of low cost printers has provided an answer to a need for output equipment to match the availability of low-cost micro and mini computers.

Future technology advances in electronics, materials and process control will continue to influence the design of all printers. Thus we can relish the future it holds the promise of lower printer prices with increased performance combined with higher reliability and virtually no maintenance. ■

■*Concluded*

Peripherals



7 x 7 Matrix character set

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IF THEN ELSE	CASE ENDCASE

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RETAILING MICROSYSTEMS

This review of the current market and a look at cast of future trends is by the M D of Currys Microsystems Ltd , a subsidiary of the Currys retail chain

The considerations of retailing are very often the last to receive due attention and, to date tradition appears to have been maintained as regards micro computers

In the UK the current sales and distribution of both personal and small business micro computers falls short from the point of view of end users rapidly becoming more experienced informed, and thus more demanding of the product and the total support services associated with it This sophistication is present from the initial contact through the demonstration, close of sale financing delivery and installation, after sales service including software update and customising the subsequent add-on peripheral sales and eventually the part exchange and trade in activity

In business and leisure as in other fields of activity micro electronics products are becoming more sophisticated and also cheaper, while the TV set as a medium for receiving information as well as for entertainment has only just begun to be exploited

For the moment however the considerable attention focused upon new technology in the home seems to be in addition to the traditional forms of entertainment rather than as a total replacement Within the small business segment, cautious and uninformed potential customers are in the main suspicious of any activity to do with the demon word computer They will remain so while the industry continues to demand a level of knowledge in both technical content and buzz word terms

Consider for example, the content of these advertisements Both were full page (one in colour) a not inconsiderable expense item

> *Our systems start to grow on you at £1450 This buys you a 32KB system with dual 5¼ inch double density floppy drives or for £2495 one with extra memory storage provided by dual 2 inch double density floppy drives*
>
> *All the systems are based upon the powerful Z80 microprocessor and S100 bus structure and can provide memory management Cartridge disc drives are available, providing up to 40MB of storage*

The other advertisement goes on in the same foreign language

> *Multiprocessing with intelligent buffered peripheral controllers 64KB RAM/PROM memory Remote communications asynchronous or synchronous COBOL Fortran BASIC Pascal and APL compilers*

The potential customer is expected to assimilate 32KB, dual 5¼ inch double density floppy drives, Z80 microprocessor S100 bus structure and 40 MB of storage All of this he or she imagines is supported by beings from outer space named

COBOL and FORTRAN under the overall direction of a European earthling named PASCAL

Not all advertisers are so remote Indeed, some are down to earth with a simple, easy-to-assimilate message about what the potential customer wants to know – those *benefits* he or she can expect from the purchase of a micro computer Those particular types of advertising generally indicate good marketing sense complete with a need for economy, a vital statistic in the current merchandising distribution activity in that a large number of enterprises are undercapitalised That is not to say that such enterprises are not doing a good job of selling but the natural result is a fragmented and overdistributed market under concentrated in some areas and over-concentrated in others

The industry has a natural parallel in the history of HIFI and AUDIO market developments At the time those markets began to take off in sales the distributor network was mainly serviced by HIFI specialists with consumer demand of a highly informed nature born of experience education and the magazine media of the time *Woofers tweeters audio feed back drive motor resonance*, and *music watts per channel* were their equivalents of 32KB ROM RAM etc etc Within a decade mass merchandising dominated the market Brand name advertising highlighting product features but mainly with an accent upon cosmetic image and appeal, was followed later by the Asian invasion adding value for money features through cost and quality improvements After initial market development by UK manufacturers came foreign domination of the market Some constructed plants in the UK and Europe but nevertheless the high level of imports placed a considerable burden on the UK balance of payments

If we consider the market position of the UK hardware manufacturers in the microcomputer industry, we will find a far lower level of representative than that which existed at the equivalent period in the HIFI and AUDIO market development If we consider the present sales and distribution network of microcomputers we will find a similarity in that the market is served by a number of specialist outlets some of whom have attempted merchandising strategies but attendant on this is a considerable proportion of business failures mainly as a result of insufficient management resource or finance The market development will surely follow that of the traditional story of a few pioneers who will survive and who knows may make a fortune but the majority will give way to organisations that can develop and sustain the market and support the end user to his total satisfaction Only by such merchandising can the industry maintain its momentum portray an image of integrity and thus achieve longevity

What then is this microcomputer market? And how is it to be developed in the short term? We take the view that the market comprises four basic segments that are and can be supported by *High Street* activity through volume merchandising and specialist outlets together with a proliferation of small to medium level distributors who are often one or two-man operations

SEGMENT A

Comprising Educational Hobbyist Home and Small Business up to £750 Initial Purchase

By far the largest segment in unit terms on an installed and current sale basis this segment is dominated by Commodore

SEGMENT B

Comprising Fanatical Hobbyist Home and Small Business up to £2500 Initial Purchase

The second largest segment in unit terms and installed base but coming under pressure on current sales activity Strong market contenders in this Segment are APPLE ITT and TANDY

SEGMENT C

Comprising Home Small Business up to £4000 Initial Purchase

The third largest segment but with slow growth to date and no clear leading contenders Japanese interest has been drawn in this particular segment and I forecast that considerable aggression from Japanese manufacturers in the coming year with their attendant thoroughness when encountering difficulties either technical or otherwise In short the Japanese learn quickly and react swiftly and positively to market forces

SEGMENT D

Small Business up to £7,500 initial purchase

Currently the smallest segment but one that will surely grow the rate of growth being dependent upon

- price level maintenance regardless of inflation
- the merchandising and marketing techniques employed

- the availability of excellent trouble free software

As in the previous segment I expect the Japanese manufacturers to aggressively attack this market segment

What of short term development?

- We expect that **Segment A** will be developed in the short term in a similar fashion to its recent pattern a high level of one or two outlet distributors together with a growing emphasis on mass merchandising through specialist microshops and High Street majors If technical developments or production scale of economy permit price reductions that are passed on to the user growth could be dramatic Software support programs will need improving if package sales are to reach mass merchandising levels Product reliability and speed of service must also be of a high level if *growth rate* success is to be translated into *profits* for both the manufacturer and distributor and satisfaction with his purchase for the customer – the most important aspect of all

- **Segment B** growth rate will be dependent upon price maintenance with peripherals built in excluding the printer and good trouble free software support with an ever enlarged applications basis If the current market leaders do not develop the products along these lines Segment C manufacturers will encroach on their trade and the segment could vanish with Segment A products coming up market to fill the void The TRS80 Model II goes some way towards the product type required to maintain the impetus in this segment As peripheral sales increase the continued existence of this segment (B) demands a printer cost of £700 + and support warranty of 12 months together with a much improved level of reliability *Speed* of service and coverage, will become vital necessities as

The High Street

will financing point of sale with the emphasis on credit or leasing as total package sales grow

- We forecast that **Segments C** and **D** will become one – on the assumption that Segment B manufacturers will respond to market forces and produce the goods required and also the greater dominance of the Japanese manufacturers particularly the multinational ones This strategy the synergy of total sales together with associated consumer-durable products will have a great impact particularly with the participation of High Street majors who can make scale purchases of the total product range manufactured by multinationals The National Panasonic Company is typical example and Hitachi could be far behind North American response could come from companies such as ITT and Honeywell although the last two companies have made little impact in Europe marketing of consumer durable products

Point of sale support saturation national advertising, field sales and sales demonstration will become the tools of the dealer/distributor this together with the total package Approach and with what immediacy required provided software delivery and installation provided in house software provisioning support provided in house and national service organisation provided in house

A considerable market share will continue to be maintained by the smaller and specialist outlet This type of outlet will tend to satisfy those customers who do not seek the packages still supplied by the major This trend may be accelerated if packaged software for the retail Apple micro and peripherals such as will in the current market place will assist the current dealer/distributor who can provide individual service to particular user need providing of course that he can manage that support and have easy access to competent subcontractors In individual entrepreneurial has survived the traumas of market evolution by their skill and enterprise But in our modern society it becomes more difficult each passing year

In considering the medium trend we have considered the growth potential of microcomputers within industry at large together with sales of control applications through such people as electrical industrial wholesalers serving all levels of industry Already there are numerous installations of such micros as Pet and Apple within large and small industrial concerns For the drawing office shack rooms, personnel and marketing departments, many concerns purchased initially on an experimental basis but systems are rapidly and increasingly being utilised as

Yoshi Inamura

New Beat at Microsystems '80

experience is gained and potential recognised

The software houses and office equipment companies have not as yet developed this market To do so will require considerable investment both in personnel to canvass the prospective client on a stand alone product basis (probably a range of three units) and in the investigation and analysis process needed to close a sale – first of the unit and then of application packages Many of the in house EDP (Electronic Data Processing) departments within industry are already overburdened with maintaining their existing schedules Other departments impatient for response to their particular EDP requirements will seek to develop

sharp fall in the price of computers, particularly with the arrival of the micro means that more and more educational establishments can and will buy computers equipment and services Unfortunately this opportunity will be modified by the Government's cuts in financial support to education

The Inner London Education Authority a staff inspector for computers has said that with the computers installed in British schools we are in advance of many countries but the curriculum development is being carried out on an amateur

Gordon Ashbee of District Computing

programs independently Company finance budget structures being what they are the impatient design engineer or product marketing manager is steered inevitably towards the micro computer priced usually below £1500 We forecast that from those organisations currently servicing industry through departments such as engineering marketing accounts and manufacturing will emerge a micro systems sales and support *wholesaling* industry Such a development may well evolve through joint ventures For example with a specialist software house or on turn key operations a marketing aspect that many electrical industrial wholesalers are perfectly familiar with

The Educational Market

More and more educational establishments are including classes and courses on computer education in their syllabus as well as turning to computers to aid with their teaching techniques How then can the distributor influence this burgeoning market?

Schools colleges and universities are outstanding targets for microcomputer hardware software peripheral equipment sales Students also are prime purchasers of the lower cost computers systems peripherals and software The basis and what is needed now is professional back up

So there remains a tremendous gap between various types of educational establishments Advertising on an extensive scale is required to bridge that gap In addition the industry must invest in personnel to determine and then analyse what is happening in computing in the school college and the university The consumers of tomorrow are being educated in using computers now If we wait to find out what they want when they possess real purchasing ability it may be too late The customer will arrive before the product a not unknown circumstance Marketing of the educational segment must be stepped up and positive product development undertaken to meet the segment demand

It is in this aspect that distributors are either remote complacent or fat cats who have enjoyed an easy ride to profits The Japanese multinationals will change all that the skilled distributor will have secured his market position by building up a good trading relationship within educational establishments And from my experience the Japanese will respect that position and proceed to supply the means of meeting the product need It does appear to be a fact of life that a successful programme will be expensive To a certain extent that may exclude the small operator from enjoying fully the development of the educational market for micros But if he is smart he can start now to gather a share of the goodies before the big boys move in

It will be possible for the industry to communicate with the education market in other ways microcomputer clubs loans of equipment to establishments unable to make purchases at this time and visits by students to manufacturers service stations, and the software houses It is time consuming it costs money and the manufacturers are in the main overseas but if the manufacturers won t develop the market, then the distributor must and as of now I see little evidence of the manufacturers developing the market They are content to supply hardware that has not been fully tested they do not stimulate peripheral development being at least two years behind demand, and they cannot coordinate hardware and software programs in parallel Generally the manufacturer states, there is my hardware such and such a software house will supply programmes This they do after a fashion but in order to really develop this market the two must go hand in hand before the product is launched Better facilities for the training of servicemen have to be provided with industry manufacturing sales and service standards imposed Only then will the inefficient and the opportunist looking for a fast buck be curtailed identified and then removed from the market

In summary I expect the market to grow steadily with the reservation that it will not be as dramatic as many pundits forecast I anticipate the major high street stores, together with specialist subsidiary outlets to continually penetrate the market at that level I forecast industrial microcomputing on a wholesale structure basis, but still leaving more than a niche for the individual operator who keeps his feet on the ground and doesn t over extend business activities *beyond manage ment disciplines that are not available* I forecast a continuing Japanese manufacturing presence albeit initially making the same mistakes as their North American predecessors, but reacting to market forces more positively and much faster I believe that the multinationals will undertake eventual leadership if only through their corporate muscle but that certain specialist manufacturers will survive and make money I believe that the one constant thing we can expect in this market is change, and dramatic change at that Just recently I read of a microprocessor capable of performing the same operations 30 times faster than the existing silicon chip and that it could be on the market within 2 years Rockwell Hewlett Packard IBM and Univac are already developing chips from this material known as gallium arsenide I also forecast a very heavy deficit on our balance of payments unless INMOS NEXOS or one of the UK electronics manufacturers really hustles ■

A Computer Age assessment of the sectors of the overall market appeared in Issue five

INTERNATIONAL DIRECTORY OF SOFTWARE 1980/81

CUYB Publications Ltd., 430-432 Holden Road, Bournemouth BH8 9AA (0202-302464) £36 plus postage

It's a mammoth work. Over 1 100 pages. Over 3 200 products in 107 categories. About 870 software suppliers. Everything is indexed four ways, so once you have broken the system you can get to the information you want with great ease and facility.

- 1. You can attach it three ways. By Program name if you already know it, the index right at the back of the book tells you where to find the detail. If you want to buy then the program details section includes up to three supplier names UK, USA and elsewhere. This takes you to the alphabetic list of suppliers where you will find a number of branches and agents listed as well so you can select the most convenient office. The lists include telephone numbers and contact names.
- 2. By Industry there are 24 industry specific categories. If any category is relevant to you then it is likely that you will want something from these lists. Each entry shows the program name and the computers on which it runs, plus the page number to find the details. It may also be worthwhile to look under the general application categories as well.
- 3. By Application Category with 38 headings for system software and 69 application areas. This is a much more useful way to find the program entries which are in a [illegible] order since many programs cover more than one category.

The amount of material is impressive. There are 210 programs for Integrated Accounting which includes some programs from Sales Ledger (137) Purchase Ledger (107) Invoicing and Order Entry (1101 Nominal Ledger (115) Stock Control (175). There are 135 payrolls. There are only a few Word Processing entries most of these are directly sold with the hardware.

When you get down to the detail you can weed out the items not useful to you. At an estimate about 40% of the programs were written in the UK and of these 50% are for mainframes 40% for minis and 10% for micros. In the micro area most suppliers seem to quote the processor type rather than the more useful system name. And I am very surprised that the initials CP/M for the 8080/Z-80 operating system is not quoted more often.

Particularly in the industry specific categories I learnt more about the industry than I knew existed. Under Estate Agents for example there are 27 items most of which seem to be US based but still may merit a look. Five are to do with matching properties with buyers which is the principal work in many offices but not the biggest problem. Eleven are to do with rented property management with some general ledger work. Four concentrate on administration and one even mentions the tiresome new ethical requirements for keeping Clients Accounts. My choice for a first place call would be the London Office of a Liverpool software house whose package runs on a DG Nova.

Is the directory complete? I doubt it. In the nature of things some of the products recently announced are not there and some of the software houses currently advertising are not mentioned. Perhaps their recent arrival is the point to note anyway. And the directory would be twice the size if Computer Bureaux and Hardware Suppliers had not been excluded. You can get their names and details from the now familiar Computer Users Year Book with a note of the industries and application areas they support. Most hardware suppliers can also provide a list of customer contributed programs which may be useful. I would have liked to have seen a full list including both these additional sources but then the book would have been too heavy to lift.

Nothing is said about quality. You have to draw your own conclusions. Indicators are the number installed, date of first installation, number of support staff, location of technical support, size and reputation of company. The program details probably give you as much detail as you would get from the normal advertising glossy. You will need a look at the user manual, followed by a demonstration. Then a couple of phone calls to existing users will enable you to ask questions about reliability and support quality.

A valuable document. I hope they will issue it every year. A copy will sit on my desk. ■

• *The reviewer is an executive with Spicer & Pegler Management Consultants.*

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HUNTING THE JARGON DRAGON

Readers are invited to write to the author c/o Computer Age *if they need explanations of any terms used in business articles*

Jargon arises for a variety of reasons some good some less worthy but when it endures for some specialist activity it is normally because it is the most *efficient* way of communicating often subtle or special concepts Alistair Forsyth s article on microcomputers in the legal profession (in issue three of our magazine) affords a very good example He writes, a solicitor effectively makes his living from his ability to interpret words and to present them in the most effective sequence for the benefit of his client Thus wordmongering profession has certainly over the centuries of its existence built up a very special vocabulary of technical terms and jargon

To give the author his due he is very sparing in his use of less familiar terms but because he writes pithily a fair number inevitably turn up

Alistair Forsyth identifies time recording and costing as the first in a list of application areas typically computerised by the modern solicitor He is right to do this for time recording and costing are at the heart of any professional business and are special to that kind of business where as financial accounting debt collection and word processing are relatively generalised problems

Because a professional office is providing a service its stock in trade is the *time* of its fee earning members and employees so it is vital to keep track of the way this time is used In the solicitors office described, each *fee earner* keeps a daily often hourly record of how the working day was spent This is a traditional record written on paper but the *time sheet* is then copied via a keyboard into the computer memory

When this information is put in it will be expressed in a suitable code which will identify both the *client* (uniquely) and the type of client and equally the job or *matter* (uniquely) and the type of job In the case of types of job or matter those which are *non chargeable* will also be recorded and, indeed sub-classified for subsequent analysis Proper knowledge and control of the extent of such activities is all-important to the economic running of a professional office In addition both the estimated and the actual time booked to each matter will be recorded and of course the total time accounted for will add up daily or weekly to the number of hours available in that period

Such a *time recording system* is a very powerful one for the control of a solicitor s or other professional s office So important is it that the system did not have to wait for the arrival of the computer to be established but is normally as old as the business itself However the burden of ensuring that the figures add up and the natural limitations of what analyses can be prepared in a sufficiently short time, have always restricted the power and usefulness of clerical time recording methods That is why a computer-based system is a natural and valuable application for professional firms As Alistair Forsyth writes time recording is clearly a case for computerisation He goes on to identify the most universally difficult precondition namely that the fee-earners have been persuaded to complete daily time-sheets Thereafter the benefits are considerable

The *Fee-earner Performance Report* shows the *percentage productivity* of each fee earner ie the percentage of chargeable time to total time Equally the fee-earner's *monthly billings* (that is the amount of money actually charged to clients) are also compared with [illegible] There can of course be a considerable difference between the amount of *fees booked* and what is billed because billing normally follows only when the whole work or a significant stage of the work is completed

The *Management Performance Report* deals with the *quantity* of work done rather than its *value* Where the work is of a repetitious nature or is fairly specifically defined in its *work content* such reports can be a useful guide to the way in which the different departments in a professional office are kept properly occupied neither too much nor too little

On the question of *accounting* solicitors have to handle a good deal of funds that belong to their clients and the *Law Society* has strict rules to ensure that each *client s money is separately accounted for* This is another area where the small computer comes into its own because while each individual transaction is relatively straightforward the multiplicity of possible permutations and the meticulousness with which each has to be separately identified make this a cumbersome job for clerical work but a natural one for the computer

Alistair Forsyth has also found computerised accounting valuable when a firm has a number of *branches* whose accounting can be centralised via a on line terminal at each branch

The *management information reporting* seems to be an amalgam of the time record and the financial record the most prominent subject of this reporting is or are *matters* roughly synonymous with what in other businesses we might call "jobs" or even "subjects' The term "matter" is clearly related to the official description of so many law suits eg in the matter of Mr X and the Royal Borough of Blankham

First on the management information reporting list echoing many a joke at the expense of the legal profession comes a report on matters not moved for n months Clients may think that they are the only ones to suffer from legal delay but it seems that solicitors also dislike work which does not progress over a significant period because it will be that much longer before they can hope to get repayment of their fees and disbursements

The next item is no less critical at times when the legal profession are finding it increasingly difficult to raise *working capital* This is the report of "matters approaching *credit limit* at *billing value* This reflects the fact that solicitors bills often mount up to a considerable sum in relation to their clients expectations or ability to pay In a well-run office the firm will establish a credit limit for each client and submit bills as the work progresses so that there is no question of the client being taken by surprise and the credit limit need not be exceeded But fee-earners do not always interest themselves in the level of unbilled charges they are running up and

for that reason a management information report helps to keep good order in the office and a healthy *cash flow* for the firm. Without such control the firm may have to wait a long time for their money and so aggravate the working capital problem.

The third management information report is a natural corollary of the second and it is useful for the business manager to know the value of all the major items of *work in progress* even if they are still within the credit limits. No doubt at times of cash stringency solicitors will be moved to accelerate the billing of these substantial matters either by completing them more quickly or by negotiating with clients for appropriate payments on account.

The *Income and Expenditure Report* would be similar in outline to such a report for any other business but the last report mentioned does raise some interesting speculation. This on is *Unbilled disbursements* by partner/manager fee earner. The partner or fee-earner who spends money on behalf of a client whether for legal dues, expenses or what ever is responsible for ensuring that it gets recharged or billed to the client but human frailty and normal business delays combine to cause this to be missed from time to time. A report identifying the partners or fee-earners who slip up in this way (or tend to be a little slow in recovering their disbursements) is obviously useful in order to alert both the miscreant and his chief or partners. An interesting point is the implication that the computer system matches every item of expenditure and re charging to identify what cannot be matched because it has not been billed to a client. Only in this way can there be reasonable assurance that an apparently innocuous but unreconciled balance carried forward is not in fact an amalgam of a large number of disputed or overlooked items (which will never be paid) reduced erroneously by deducting some more recent set of recovered disbursements.

Definitions

> *'Clients may think that they are the only ones to suffer from legal delay'*

I would take issue with Mr Forsyth on one point of terminology namely where he refers to *over bills for counsel* and by way of explanation and description goes on to write "If any activity looks out of place the user takes a magnifying glass to it by calling up a more detailed report further down the pyramid (of information)". I would call this *demand reporting* rather than reporting by exception. The pyramid style of reporting assumes that there will be a regular report of the information at the apex of the pyramid whether the [illegible] mark able [illegible] reporting those matches [illegible] timed in a month [illegible] ding to plan [illegible] porting techn [illegible] tional and only [illegible] tions is specifically required.

The [illegible] debt [illegible] aders who are [illegible] or relative the [illegible] which may [illegible] automatic reminders [illegible] aggressively softer terms [illegible] don't pay up within the [illegible] period. It is normal for [illegible] end with one which [illegible] the debt will be placed in the hands of a solicitor for collection.

And that is where the system described by Mr Forsyth takes over. The computer writes the requisite *letter of claim* then prints a *summons* and a *request for default judgement* etc. This automation would seem to some business people too good to be true. If only they could get hold of this debt collection program they might hope to save themselves a significant amount in annual legal fees. But that is unlikely to be countenanced by the Law Society and it would probably not work out quite so easily for the do-it-yourself merchant who would still have to deliver his letter of claim, serve his summons and appear in Court. Until robots are more versatile you cannot do that by computer. ■

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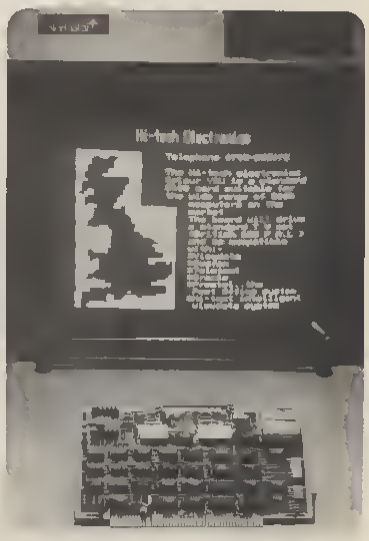

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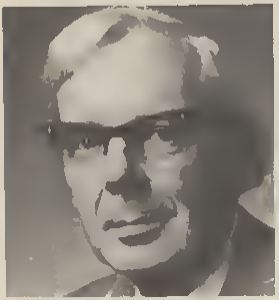


As important as having a computer on your desk is knowing what to use it for and when to use it

DATA OR DECISIONS

The microcomputer is certain to be a much used tool as a number cruncher and few would doubt its ability to handle quite complex or repetitive numerical calculations. In this sense it is an extension of the slide rule calculator and accounting machine and can enhance the efficiency of many businesses both large and small.

But when it is considered as a means of handling language for example by means of wordprocessors in combination with arithmetic it appears to offer a new dimension to the manipulation of business information of all kinds. This facility coupled with the notion that information *per se* is a good thing may mislead managements into exploring rather than exploiting information. The true benefits of having microcomputers at the manager's fingertips may therefore be lost in the enthusiasm to develop programs gather data and present him with a superfluity of messages, reports and figures which he is supposed to call up on his TV screen at the touch of a button. Consequently managers may reject the computer and relegate it for use by clerks and typists.

It is therefore more important than ever to question what the business microcomputer is really for.

What information?

Nowadays even a one man business has to handle an increasing amount of data and the quantity escalates rapidly as the size of the business increases. Conventionally the data is categorised as accounting, sales personnel production records etc. The system for handling all this data is often thought of in terms of administration information storage and retrieval typing and so on. It is all too easy therefore for data processing to be split into increasing numbers of compartments which individually can show justifiable reasons for increasing their capacity with out too much reference to the flow of information throughout the system as a whole.

An alternative way to categorise the information within a company is as it flows

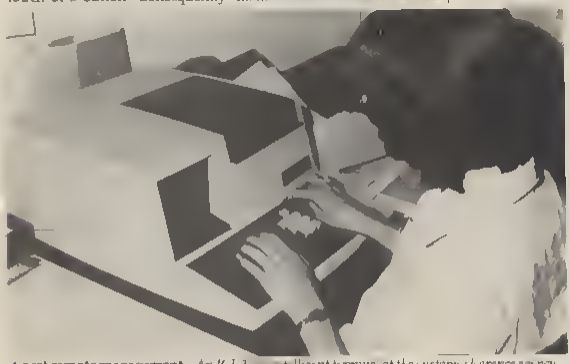
- 1 **Storage information**
  This is information which the business has to supply by law. It includes such items as annual accounts tax returns health and safety data.
- 2 **Information for other people**
  For example — orders invoices sales literature technical data etc.
- 3 **Data for own business**
  The data essential to keep the business going as it is such as wages stock records production schedules.
- 4 **Information for decision making**
  This embraces the information which is necessary to prepare plans and to deal with changes.

For categories (1) (2) and (3) the objective is presumably to provide the minimum of data or information and at least cost. It is therefore very important to probe continuously *what the information is being used for and by whom*. Perhaps it is out of date or could be presented differently and in a more cost effective form. In other words, productivity is the overriding consideration.

The computer provides the opportunity to increase this productivity. Just as manufacturing has achieved great increases in productivity by putting more energy into its machines and improving their technical performance so the computer enables us to handle more data and at a higher rate.

In this type of application computer investment will tend therefore to be judged by the usual yardsticks of labour saving and cost per unit of output. In many cases this analysis may be all that is needed to show that there will be an adequate economic return. Most businesses however will tend to look at a somewhat wider picture and consider what *organisational changes* may be necessary elsewhere in order to keep pace with the potentially higher output or to improve the formatting (layout) of the material being fed to the wordprocessing unit. There is little point in expensive machinery standing idle whilst someone hunts around for the correct data to feed to it.

As microprocessor technology makes it



Local remote management *An ICL intelligent terminal at the customs clearance agency Harcourt Shipping Agency Ltd. The terminal installed by Bath Computing Services enables management reports for the directors of the agency, on a monthly basis.*

possible for some — and may be all — of this computer power to be placed on an individual's desk the economic issues are substantially altered. The simplistic productivity arguments can still be applied to the routine elements of the information process but as soon as the computer can be used to help in making *decisions* we become more concerned with the usefulness of the information being provided by the computer and the quality of the decisions reached.

Decision-making

Broadly speaking decisions are necessary either to choose between options already laid down or to adapt a plan to changed circumstances and, of course these decisions are being taken all the time throughout a business. The former type of decision could be that of a buyer who has discretion to purchase within prescribed cost limits according to a range of quality standards.

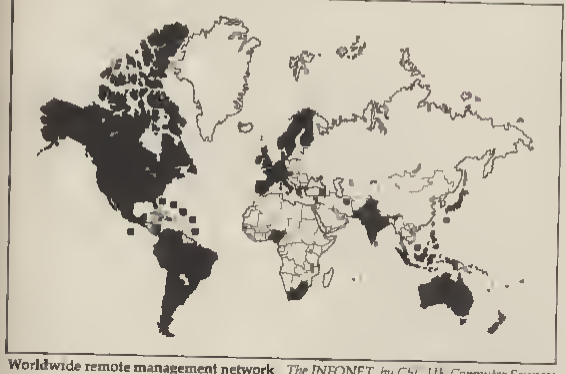
An example of plan adaptation often referred to as crisis management and far more common than people realise could be top management's need to change the product strategy because of the sudden closing of an export market.

Decisions

they need to be able to make a certain analysis over a range of options which have not been pre-determined. Such people therefore need a tool with which they can interact and try out their intuitive ideas.

The computer for personal use would seem to be such a tool. It can store considerable information and a range of powerful assessment programs. Without elaborate peripherals the hardware is sufficiently cheap to be left idle like much other office equipment. The catch of course is software.

Computer programming is perhaps not too difficult to learn but writing *good* programs is certainly time consuming. Furthermore hardware and programs are often incompatible so that transfer of programs between users may also be tedious and expensive. It is all too easy therefore to adopt programs which automatically prescribe the scope for analysis and create the situation where more time may be devoted to up dating the data than working out the consequences of alternative decisions.



Worldwide remote management network *The INFONET by CSC UK Computer Sciences Co Ltd is a remote computing system. It comprises some 20 Univac 1108 processors and 3 IBM processors linked via telecommunications channels. Remote concentrators are located in the major cities of Western Europe and North America. The network is accessible by terminals ranging from telex machines to high speed machine-to-machine direct links. Company data is protected and public data is available.*

The person faced with making fixed-option decisions is primarily concerned with

- referring to previously prepared information
- doing some calculations, and
- making a deduction.

The data can be supplied from a central information system and may be conveyed to him on paper or via a VDU but he does not need to be able to input to a computer.

However those who have to plan or adapt to sudden changes in circumstances are concerned not only with information but also with the need to *explore the consequences* of their decisions. At the very least

Programming difficulties may therefore militate against the real value of the micro computer as a personal decision making aid. The individual does not have time to handle complicated routines and yet he needs to be able to modify his programs to suit the changing situation which he is analysing. There is clearly a need for simpler programming languages the provision of program modules which can be taken rather like words in a dictionary and strung together to suit individual purposes and above all there is a need for translator programs which will permit access to the full range of software being built up throughout the world.

In the meantime it is pertinent to question whether the potential for this use of micro-computers is an illusion. The provision of the multi-terminal may not only reduce the time available for real thinking, but also the inclination to think. There is much more that people suffer mental indigestion than real thinking may actually be more efficient if information were provided. Even intuitive thinking may be no bad thing.

Get the Ground Rules right

The issue therefore is how to influence the providers of hardware and software. Large organisations can afford specialists to analyse their needs lay down specifications and initiate modifications to suit the changing business requirements. The smaller businesses have neither the time nor the money to keep changing their software but their need is as great as that of large businesses if may in reality be even greater because they are more vulnerable and have to react quicker.

Decision-making is really a process of asking about the future.

The interactive capability of the computer should therefore be used to clarify whether the right questions are being asked rather than responding with a mass of information which requires continuous and costly up dating.

For example it may be more productive for the computer to come up with the name of the person to ask about a particular problem than the solution itself.

Some years ago a large American company prepared a directory of the skills — both professional and extra curricular — of all its employees and was astonished to find how extensive these were in range and depth of knowledge. Many of their decision makers were not even aware that the information they required was already available to them simply because it was not fed through the normal company information system.

The economic value of a micro-computer as a tool to assist the individual manager to make more effective decisions may completely outweigh the cost of the hardware and software. However, this potential can be easily lost if the software is too rigid in structure requires too much data or is too difficult for the individual to modify to suit his changing purposes.

Managements who are considering investment in Personalised computers should make sure that:

- The information base from which these computers will draw their data is designed so that it can be continuously and cheaply stripped of inessentials.
- The software provides the computer with the additional function of questioning the question. This implies that the user should have access to as wide a range of programs as possible and be able to alter them easily. Managers need to be able to communicate with their computers in simple terms and in an understandable language — as they do with their colleagues sitting round the table. ■

The author is a management consultant and technologist.

A NEW AGE FOR THE ACCOUNTANT

Alex Harrison FCCA FCIS had it all figured out long before the awakening. Here he tells how.

The lot of those who live through periods of rapid change has much that can be envied.

The first Elizabethan age, the age of Galileo and Newton, the early days of Einstein and Max Planck must have had their own exhilaration.

It may seem surprising to say so but for a small number of men the last few years in professional accountancy may have had a similar sense of pioneering and walking along new frontiers.

Perhaps for the first time since the invention of Trial Balance and Control Accounts, new techniques have been found to prepare accounts.

When these new techniques make use of so wondrous a thing as the modern computer the thrill of discovery is great and sustained.

Since 1954 I had been the principal of a small accountancy practice in the Midlands.

Like many then, and for a good few even today, nothing had changed over the years. In fact in my old files I had specimens of accounts and working papers of previous accountants in the area going back to the 1920/30s.

Opening those old files it was difficult to notice any change in form or technique since those days.

Except for the date it was impossible to tell the accounts of 1970 from those of 1930.

What are known as the principles of Incomplete Record Accounting had remained as they were. Even the old form of Profit and Loss Account and Balance Sheet were the same, with their red underlining and precision of balancing to the last penny.

Decimalization made the old brief size account look out of place. £120 92 fills a lot less space than £120 18 6d.

A few brave souls began to experiment with strip and vertical accounts. A few even braver thought to show accounts to the nearest pound.

But decimalization did something more. It meant that the awkwardness of calculating in pounds, shillings and pence could be replaced by the simplicity of calculating in decimal notation. At the same time the pocket calculator and simple listing calculator like the Olivetti Logos came on to the market.

'Except for the date it was impossible to tell the accounts of 1970 from those of 1930'

Like many accountants of the period I was hopelessly behind—it was before VAT had improved the Nation's book-keeping—short of staff and living hand to mouth between one Commissioners' meeting and another.

We never seemed to get adequate typing staff and as soon as anyone had learned enough he disappeared into industry or local government.

One day my secretary said that there was a young man at the door who wished to sell me a device for calculating this new thing called VAT.

It was at that time at the rate of 10%. Anxious to show any young man that I could calculate at 10% I went to the waiting room door. I had a tax assessment in my hand. He had a listing calculator ready.

'Can your machine' I asked 'work out other percentages than 10%?' 'Yes' he answered, 'to the 11th decimal place.' 'And add and subtract?' I asked. 'Yes' he said, 'to 10 E 99.'

I checked the assessment. It was right. I called a member of the staff and asked him to check the assessment he was working on. It too was right.

I turned to the young man and saw the look in his eyes that I have now often seen in the eyes of computer salesmen. He was in a happier world than ours—spending his commission.

I bought two machines. After we had got used to them we tried experimenting in the preparation of accounts.

On one we prepared a list of sales, on the other purchases or cheques paid and money paid to bank. New worlds were opening.

Sometime later the young man came back. 'We have now produced a machine with three registers,' he said. 'I wish you had one with a hundred.' I answered. 'Well' he said, 'I don't do it but others in the Company sell one that can. It uses a magnetic tape.'

I saw a demonstration which I did not understand but I was quite prepared to trust a young man who had made our lives so much easier. I ordered one which I took to be some sort of analysing machine.

The demonstrator said 'Don't worry about all the keys marked ½ or ¼ or anything like that. When we have set it up we will cover those up for you so that you can forget them.'

'Oh no you won't' I answered. 'I want to play with them.' He looked at me with the air of one who was not going to lose a good order by arguing.

The machine arrived. It was an Olivetti P603 with a magnetic tape. There was a book of instructions which rumour had was the English translation of the Japanese version of the original Italian.

'How does it work?' I asked the mechanic. 'It's a small digital computer' he answered. 'If anybody had told me that it was a computer in the first place I should not have bought it. I was too old and too simple minded to learn about computers.'

'I now know that the ninth beatitude is "Blessed are the simple minded for they shall program computers".'

'Don't worry' said the mechanic, 'you just think about it until you understand Indirect Addressing. If you can understand that you can understand computing.'

The Olivetti P603 had 5K of random memory and about 100K of back up on a Magnetic Cartridge

It would add one to one six hundred times a minute It seemed tantastic

It had its own letter code language and could jump on positive and negative It was the devil s own job to correct an error especially an omitted instruction The number of programming steps was 112 if I remember rightly

It had an ordinary electric typewriter output which would only produce upper case although lower case could be obtained by a queer coding device

It had so many little features that weren t in the instruction book that delightful surprises were always in store for programmers

But it was a computer After a time I produced a 64 register analysis program programs to type out accounts do VAT etc

I bought a paper tape punch and reader and felt like a pioneer

The Inland Revenue Authorities took some time to get used to the idea but in the end became almost enthusiastic

We called the computer FRED for Full Records Every Day and inspectors would ring up and ask Get your Fred to print out a schedule of fixed assets or repairs

The next computer I bought was an Olivetti P652 This had a 2K main memory and in time a little fixed head hard disc with a storage of 160K

This computer was a joy and the little hard disc a delight to use Its access time was out of this world I still have it with tape reader and punch disc and typewriter The P652 was much faster than the P603 The programs were most sophisticated and it really was a computer

Other accountants got to learn of my system came to see it and wanted to buy one for themselves

A funny thing happened Olivetti didn t want to sell it to accountants They wanted to sell the P652 for scientific work only In the end we sold getting on for a hundred to other accountants but without any publicity or advertising

At the time this annoyed me because I felt that my system was the first successful system for practising accountants and it hurt not to have it accorded its place in the development of the business computer

Olivetti then developed a similar system on their Audit 5 which I believe was successful

To program a computer at my age was

Experience

a real eye opener Computer for a purpose for which the manufacturers didn t want to sell it gave a delightful air of unreality

By the time floppy discs VDUs and high level languages like BASIC were becoming popular

I bought my latest computer a Wang 2200VP with twin floppy discs and daisy wheel printer In this I have programmed and installed a Wang 3200 MVP with multi terminals hard disc single floppy disc drives and daisy wheel printer

Seeing that I didn t start until I was fifty two and not even in my sixth year it says a lot for how simple computing really is

What accountancy will not do is to go back to simplicity and yet accounting itself is a simple concept it merely records where money has come from and where it has gone

The best accountants are simple minded and so are the best programmers

My office is therefore using its third generation computer and is well beyond the revolution other practices have not yet undergone

'And yet accounting itself is a simple concept'

In a sense it sets us apart On the other hand I have been careful that computer programs in accountancy follow the procedures which are usual in every office

It would not be wise to have a Computer accounting profession distinct from the Non computer accounting profession in such a way that one trained in the one could not easily work in the other

Programs should be arranged so that, say in incomplete record accounting the procedures used by hand are closely followed

The usual method is to

- enter cheque payments and bankings
- reconcile and balance the bank account
- enter sales cash receipts cash expenses and purchases
- balance the cash account
- make adjustments for creditors repayments VAT Hire Purchase etc
- depreciate fixed assets
- enter stocks etc

The computer does these in exactly the same way as by hand and to that point can be considered as a piece of Electronic Analysis Paper

The difference between preparing accounts by computer and by hand is roughly the difference between a photograph and a moving picture

An entry of say, a cheque payment for purchases will for instance update the bank account the nominal account, the gross profit percentage the gross profit the net profit the trial balance etc All this will happen at the speed with which a beam of light will travel between the two goals of a football pitch

This raises an interesting problem about job satisfaction

Many people – and computer advertisements are largely to blame – think of a computer at which sits a young lady of innocent years who feeds in information

Somehow all this information is processed and goes to somebody else for review

Nobody has ever been able to prepare accounts that way with or without a computer

The computer can be thought of as an instrument panel in a modern aircraft at each moment reporting to the pilot details about the flight to assist him in his control of the flight

This is what is known as the interactive use of the computer

Here the computer and the operator are working *together* to produce an account each doing what he is best at the computer to store calculate and display information the operator to accept or modify that information in the light of his knowledge and experience to read information which is only readable by human eyes (like bills and invoices) and to judge and decide

The best person to judge accountancy is a qualified accountant They make the best operators

Someone in London asked me Do your accountants mind being called machine operators? "No more than your s mind being called pen pushers I answered

If programs are going to be used by highly intelligent people they must avoid being boring

The information displayed on the screen should be arranged as by a good printer or at least in the way a good typist would

Screens now display in lower as well as upper case

The facility should be used All upper case is flat and boring and is a form of shouting at people which is neither helpful nor necessary

Routines should be able to be changed with ease so that the operator can vary what he is doing and if he has spent some time on one thing do something else for a

change to break [illegible]

Information [illegible] the screen as neatly as possible [illegible] could expect to find [illegible] paper [illegible]

The modern VDU can often generate graphics and these should be used. Two tone screens and blinking displays are useful

The computer should be neat and clean and in a pleasant environment

Accounting is not something you want to carry out in something that reminds you of a Colt Ventilation Advertisement

It is difficult for anyone who has not used a computer to realize the number of changes in thinking it causes

Preparing things by hand necessitates a set order. In accounting it may be

- Post Nominal Ledger extract Trial Balance
- Prepare Accounts Prepare Tax Computation

In a computer all these matters are happening at the same time and there is no reason why the tax computation shouldn't be printed or displayed first

Of course at the moment it might be a little unusual to write to a Tax Inspector and say "Here is the Tax Computation. If

Experience

you want to ask [illegible] have the answer [illegible] the future?

Again VAT returns [illegible] computations management [illegible] accounts and final accounts [illegible] pared from the same information

The difficulty at the moment [illegible] the basic information. What [illegible] with it afterwards is a matter [illegible]

This is a difficulty only because the basic information of accountancy cannot be read by a computer

When banks etc. supply their information in a way that a computer can read we may enter an even newer world

The effect of the computer on the normal provincial accounting practice is considerable

Accounts which take a day and a half to two days to prepare by hand usually take about two to three hours on a computer

Computers will always balance never make an error of principle a spelling mistake, will type out as well if not better than the best typist

The training of staff to use them will be difficult. The army of first- and second year clerks will be without gainful employment. One imagines that there will be a long training course for the few accountants necessary and then they will go on to the computer as Accountant Operators

The number of people employed in provincial practices will drop dramatically over the next decade. At the moment it is held as high as it is because professional practices cannot advertise and it is not easy to find use for a computer from the personal contacts of the past

The modern mini computer with multi terminals which are just becoming popular will raise a new problem. A small computer for about £40 000 with eight terminals and foreground and background programming could do the accountancy work of a fair sized provincial town

What is not realised is that it is here already. Accountants could buy and operate such computers today

It is no longer a problem of waiting for the future but using the faculties of the present. Except for its inertia the world of provincial accounting could be changed completely in six months

Very few people know this at present the rest sit with a time bomb ticking beneath them ■

Fig 3 from P58

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  CM IN [illegible] ALL YOU C [illegible]
[illegible]
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SMALL SYSTEMS FOR BUSINESSES

MARLENE BROWN talks to CARO MINAS Financial Director of Harrold Leather Manufacturing who took a risky thrust into custom programming, chose BCL and never looked back

When Caro Minas says 'Small is Beautiful' it means that he is busily building his management team to move even faster into the 80s

Minas is the Financial Director of Harrold Leather Mfg Co and for him the computer proves invaluable, it is not just a management tool, it has given him a competitive edge and his company has accomplished what others tried and failed to do in the tough competitive tannery business "I have told all my competitors that they are mad not to have a computer" he says In fact they should be going out and pulling the computer into their offices, not waiting for the supplier to come and sell to them

Picturing the role a computer must play in making a business a profitable enterprise is indeed challenging and as Minas rightly says "It is damn hard to know exactly what you want, when you are entering a new thing like this because you cannot appreciate the computer I had no idea of the parameters involved and with all that you are completely blind"

Minas, who spent a lot of time researching how existing systems support their various business-user operations advises the first time user to be cautious and thorough before deciding "The road to actually specifying things is a lot more detailed than the layman would imagine There are a lot more traps and we were fortunate because we did not fall into any particular big traps but we certainly fell into a lot of little ones and of course it all costs money to get out of it," he says

The company ran a harder obstacle course than it first envisaged "In a way it is rather flattering because we have obviously come through it very well,' says Minas The system analyst from Business Computers Ltd (BCL) a man of considerable experience in the computer world says it taxed him almost to the limit and the programmers who wrote the programs said it was harder than they first thought

All the storm signals are present when a business ventures outside the realm of standard software packages, and according to Minas there are two dangerous steps ahead "You don't know how successful custom written software is going to be, how much it will cost and you have got to rely completely on the assumption that the software house and your company are both communicating and truly understand each other"

In retrospect, he says he is lucky to have come out anywhere near the correct length of time, at the right price and still be friends with everyone He says he cannot keep away from computing and writing programs which is perhaps one reason why he can really appreciate other people's problems

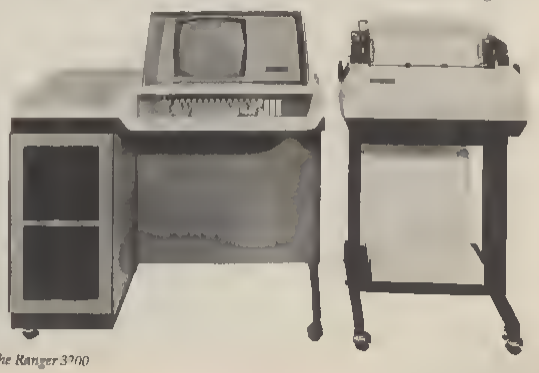
Harrold Leather Manufacturing, Bedford incorporated in 1922, is a private company engaged in the dressing and finishing of leather, working only with calf goat sheep and light buffalo skin, which are imported in the crust state – namely vegetable tanned The skins are then retanned as necessary to change the tannage to semi chrome before dyeing and finishing to the customer's requirements Customers are mainly in shoe manufacturing but the company also sell to upholstery and accessory manufacturing concerns

Turnover is limited to £5 million maximum production and turnover per employee is almost £42,000 Between 60 to 67%-turnover is the cost of the basic raw material bought from all over the world but mainly from India, Pakistan, Nigeria South America and Australia All this is set in a framework of extreme competition from every Third World developing country

Before joining Harrold Leather, Minas was an accountant with Coopers & Lybrand the international firm of auditors and it was there that his work led him to computing At Harrold Leather he saw the computer as an absolute fundamental requirement for the success of the tannery business It promised speed, accuracy and computing power at a low cost

Setting his objectives in early 1977 he looked first at bureaux services and timesharing facilities but found them too expensive He then called on some of the larger computer manufacturers who quoted £40 000 to £43 000 Just as he was about to give up the whole idea, he received a call from Business Computers Ltd (BCL) in Leicester "The BCL guy wasn't insistent He just wrote and said that he could help us because he knew a bit about the leather business' says Minas The man from BCL was Geoff Gandy, a professional salesman in every sense of the word who came up with a specific quote and a definite timetable Minas was impressed Gandy showed me that he could undercut this amount by quite a margin so I invited him along to give me a firm tender and I was amazed how quickly it all went The BCL quote was £13,000 for the Diablo 3200 including screen, two floppy discs standard software installation and training on-site Gandy suggested a custom-written sales and stock accounting package for £5,000 which brought the total cost to £21,000, with an extra screen and Shugart disc drive

Minas wanted the hardware and software from one supplier, with a system that had a great deal of expansion capability Appraising the market, he wrote to about 50 systems houses and computer suppliers He accepted BCL because they were the cheapest Minas says that BCL took competitors' criticisms very well, simply stating that they knew the capabilities of their machine and could guarantee that it was right for the job "I thought, how



The Ranger 3200

wonderful! People who take a positive attitude and do not push anyone else down to put themselves up "

The Diablo Ranger 3200 (S type) with 40K bytes core memory four discette drives (capacity 2 4 million bytes) two VDUs and one Hytype printer 45 cps (the four discette drives will be replaced by a 44B hard disc, 10 Mbytes), was installed in Harrold Leather s offices in October 1978 The company use the purchase and nominal/wages standard BCL software

When the Purchasing Director retired after 55 years service it was a real blow to the company 'You cannot replace 55 years of experience but the computer has done near done that because it produces for another Director all the management information he needs He can now compare yields and come up with answers only three months after doing the job, which would normally take someone on a manual system nearly 30 years just to get the feel of it" says Minas

The more exciting updates are on the sales and stock accounting side Minas says that the struggle in the software development process is when it becomes a toss up as to whether you should stick to the standard packages and change your company s methods of trading to suit standard packages or just do without a computer "The computer is not really that simple, especially when you get into custom programming where there is a huge gap between this and standard software" he says "You might think that because you have it specially written for you there might be one or two little problems but it is not so – it is quite a different world and there are lots of drawbacks in it too"

The software problem has been with us a long time and continuous attempts are being made to improve the quality of custom programming, to permit the end user to be more productive Minas hopes to take advantage of BCL s new and improved programming on the sales and account ing packages 'BCL may develop it so that custom written software which has been fairly closer to the original standard package may be able to use it" he says

Manufactured by Diablo a wholly owned subsidiary of the giant Xerox company, the Ranger can be used by the smaller firm to carry out all or some of its commercial data and word processing or by the larger firm as an intelligent terminal with data communication capability with all recognised larger computers

How do you get to the situation where every business that had a typewriter now has a computer? I asked BCL s Managing Director, Mike Munnelly To this he unhesitatingly replied 'The only way you can do that is to offer them low-cost hardware that is available today together with very good packages easily changed if necessary easily developed or taken in individual bites, rather than take the whole package or not at all Then you get maximum penetration' Businessmen intending to use low cost hardware are often frustrated by the handicaps imposed by writing programs and Munnelly says that the only way we can resolve this problem is to offer them low cost hardware together

First-Time User

with very good comprehensive software packages

Management of smaller companies seem much more open-minded about ways of improving the business than they were perhaps 10 years ago and there is an encouraging change in British industry today Looking back Munnelly says, 'There was a time when businessmen said We do not do it like that Now they say we do not do it that way but perhaps we should try, and they will use the computer and software packages, often changing the nature of the way they do business especially if it proves more efficient and cost-effective

In an all-out effort to achieve success in the software development process, Caro Minas tried to learn how to program and understand the computer because as he says, he felt he was losing his grip on the whole situation On standard packages the incidence of error is very small because they are well tried they are debugged properly but the whole point of our computer system was the sales and stock accounting package ' Warning the small business man who might have an accountant but might not always have anyone in-house to liaise between the company and the computer programmer, Minas says Lord knows what would have happened I took manuals home with me for a good six to seven months where I was working till eight or nine each night

'They are mad not to have a computer'

The only way to learn to do software development is by on the job training All BCL users are trained to respond to a variety of problem situations and the company run a number of applications programming courses

BCL has four software locations at Boghton, London, Birmingham and Manchester and the remainder is put out to registered software houses At Harrold Leather Mfg the systems analyst was from BCL and the programmer from the software house Davis & Brown an agent for BCL, who also sell the Ranger equipment software and support turnkey systems Throughout our relationship I found BCL and Davis & Brown very professional – deliveries are on schedule and their follow up procedures are very good because they always check to ensure that the sytems hardware is working well,' says Caro Minas

BCL works on a strategic planning style allocating four different types of personnel to work with their customers by assigning priorities to their varying activities The BCL salesman will find prospective customers and start negotiations the sales man in turn is supported by the systems adviser who assists him to focus entirely on finding a system to cope with the customer's needs discussing in detail the company s future objectives Working along side the salesman the systems analyst will write a proposal so that the customer knows exactly what he is getting, how much he is expected to pay for it and how it will affect his business Soon after the order is signed, the adviser and salesman continue to set up a dual-reporting structure by means of progress meetings with the customer; and together they draw up time scales to make sure they meet the target goals

On the programming side there is a project leader to overview the writing and testing of programs The systems specification is written and coded by the programmer assisted by the adviser but in some special circumstances the programmer might play the dual role of both adviser and project leader Throughout all this the salesman stays in total control and for good or bad, it is his account says Mike Munnelly 'It is his privilege but it is also his responsibility and his job that his customer is happy

'You want a happy customer because he is possibly going to extend his system and he will recommend your equipment to his friends and he will also be a source of useful customer reference in the future

We will not take an order if it is likely to raise a question mark or risk says Munnelly Because when we take an order we incur a lot of responsibility and, hopefully, a relationship that is going to last for a long time

Caro Minas says it is a lack of effective communication between operational staff and management that leads to what appears to be data processing disasters Fortunately my Chairman was very up to date in these areas – he believes in computer industrial democracy and he liaised very closely with me all the way

On a first time excursion into computer programming, Minas wanted all his in house staff to participate fully He found that generally they best liked actually working on the equipment The filling in of books and filing away of data was an office chore but actually working at the machine was the end product for them which brought final job satisfaction All staff were given a chance to operate the computer and be in control By centralising jobs some staff took charge of invoicing nominal ledger, cash book while others took over stock control wages and salaries without having to go through the intermediary of a computer operator or DP manager who would take control away from them

It does introduce some worries because if people are industrious and want to do their job well and if the system has not been designed properly then every time they hear a bleep it could almost give them a nervous breakdown ' says Minas

Under the supplier s guidance the customer can set up his own files 'Once the computer system is up and running once people have the expertise, then we are available all the time says Mike

The whole tannery business is fraught with problems but the company is export-

ing nearly 85% of their output Since the computer, staff now know when to do things how to react to past changes what sort of margins exist – making it possible to interface the sales order book with the stock resources, he says "We never had this in the past and it would take a man a day and a half to produce manually a fraction of what we produce now in a few minutes

Applications programs

The sales order processing will allow customers' orders to be accepted and entered into the system against which process dye tickets will be held and invoices will be produced automatically Orders will be allocated against customer contracts or blanket orders

An order enquiry facility will allow interrogation of orders on the computer either current or held in the history file by accessing the sales confirmation note Enquiry facilities will enable management to examine any order by either order number account or agent number An enquiry on a blanket order will detail all call off orders against the blanket An outstanding or forward order report will detail the position of all orders through production and either highlight those outstanding or show the forward commitment of all orders

A number of sales analysis reports are produced as a by product of sales ledger invoicing including analysis by product category in country and agent sequence

Monthly statements are produced from an open item sales ledger and a detailed aged debt analysis is available at any time to provide management with information to maintain an efficient cash flow

Sales ledger invoicing allows invoices to be prepared for the sale of raw material or finished stock or any item outside the normal business The program also allows for the production of manual invoices

First-Time User

Once orders have been entered onto the system and an expected delivery date entered the order is monitored throughout production When the raw material leather has been sorted into type, grade, thickness or weight and put into work, a process card or dye ticket is raised The ticket indicates the customer sales confirmation note number finished leather colour and substance required Entry of varying comparison dates will indicate orders overdue or commitment forward over any time span Throughout production the location and weight of leather being processed on each dye ticket is available on enquiry

The outstanding and forward order report will provide management with information concerning the production of leather in the works by indicating the overdue position of all orders and also the expected forward order position

The purchase ordering (contracts) program will update stock on order details of which are subsequently updated by the arrival of supplier invoices which precede the goods This also generates the production of white sheets which represent stock in transit and are subsequently used for costing purposes at the first sorting The purchase ordering routines are applicable to both raw materials and finished products

As it is essential that accurate costings of rough stock are made the system will compare the actual costs from the white sheets eg the supplier invoice against the allowed costs from the dye tickets based upon selling prices within the sale confirmation notes A finished costing of both leather being put into stock and that invoiced compares the actual sales value obtained directly from the SCN, and the allowed costs obtained from the dye tickets in operation against the SCN

The system will also produce an evaluation of stock either in the raw material state, work in progress stock or as finished stock An important aspect of the system is to provide information relating to the total stock resources of both raw material and finished products, and compare it against the sales order book

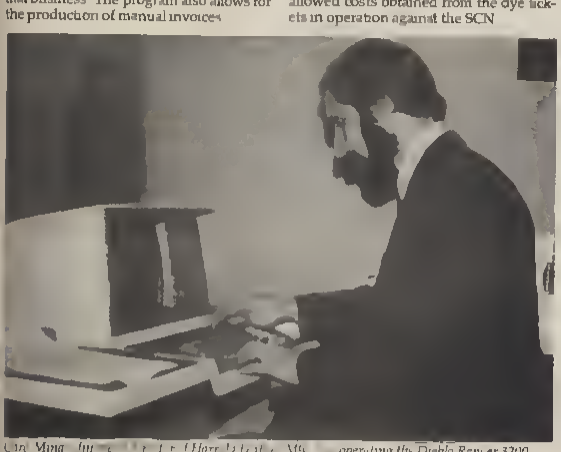
The programs for file maintenance have common operating procedures and provide for adding new records in the file deleting records changing data and printing or displaying data for selected records A sub-menu of each option is displayed to the operator upon which the respective code number is selected

Upon entry of the required menu number, display change delete and print will be displayed as job options The system will sort through all new records entered and merge them into the master file after which a list of all data entered is printed and it also ensures that duplicate records are never held in a master file The system recognises the existence of logically deleted records and enables enquiries to access such records but ignores them for the purpose of reports

BCL's written programs should be able to support the customer for a long period of time well into the 1980s, in so far as the machine itself is capable of enhancement and able to cope with the addition of new and advanced peripherals namely, fixed discs, light pens, etc which will be interfaceable to the system Caro Minas, who sees a long term relationship with BCL says that if he ever trebled his turnover or doubled in size he would still go for the Ranger

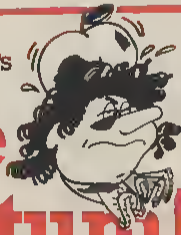
For the future, Minas would like to move closer to a real-time system and this he says can only be achieved by providing input terminals at the point where the information originates "This will have to be considered very carefully because one tends to lose control over the accuracy and completeness of the information I feel we will only be able to advance into this area when we are fully confident of the operator's appreciation of the system," he says The company are also considering the use of word processing to store recipes for the tanning and dyeing of drumloads of leather

Recalling a conversation he once had with an MP, Mike Munnelly says "I personally have enjoyed very much the sense of pride and pleasure it gives me to put a computer system in and to see a firm prosper and flourish all on the back of that system It gives the small firms a chance to compete and to offer a level of customer service that relates to that which the big firms can offer I feel that we have contributed immensely to the economy and to the employment levels To achieve an open and flexible participative approach calls for a certain amount of discipline with dedicated people within the user company At Harrold Leather, the computer has given staff more enjoyment, more commitment and more job satisfaction but most of all it gives them a real pride to say that their company is keeping ahead with computer technology and change Small is beautiful ■



Caro Minas [illegible] of Harrold Leather [illegible] operating the Diablo Ranger 3200

Isaac Newton's easy solution!



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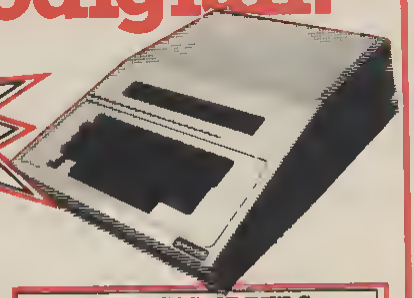

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Programmed learning

In his article (Using a Micro — Issue 3) David Walton asserts that programmed learning tried to provide a *complete* learning environment and hence failed and that customer resistance is due largely to ill fated programmed learning experiments — No good can come from such wild and uninformed claims

I can only guess what he means by a complete learning environment and I am not at all sure that programmed learning has failed Judged by the relatively small number of published programmes this may appear so but it has left its mark on teaching methods and training schemes

With the new possibilities offered by the computer it is pathetic that Walton should be confining its use to marking and filing Now more than ever before we must be sure to get programmed learning right My experience leads me to believe that programmed learning is not where it should be today because so few teachers really grasped the fundamental principles It is not just putting learning material into short steps It is not simply providing knowledge of results nor is it simply calling for active responses

The construction of an effective programme requires a highly analytical approach the delineation of concepts in a rational sequence and demands on the application of these concepts in problem solving Recognition of this needs an experience something akin to insight in the true Gestalt sense — paradoxical as that may be! If some of the people who struggled with cantankerous stationery and cumbersome machines in the sixties had had access to the facilities of the computer the story may have been a completely different one Programmed learning will come back The line that Walton takes may delay it but when people who can teach are themselves at home with the computer nothing will hold it back

The problem seems to be this — how can good teachers be made familiar with the enormous possibilities now open to them? The computer people get hung up with the technicalities and the application to PL is ignored Teachers capable of programming are baffled by the technicalities (If anyone doubts this where are the programmes to teach on to use computer facilities?)

One gets this feeling of deja vu The old teaching machines have gone The new ones are here to stay because they will be used for purposes other than teaching But they will not be used for teaching until someone with sufficient imagination can bring the machine and the teacher together as an effective unit

There is no customer resistance when the customer wants what is available

William Stephen, Head of Faculty of Education Downshire House Roehampton Lane, London SW15 4HR

Editor's Note William Stephen is author of the programmed text Entry to Algebra — Methuen 1966 and has written Why the Prejudice? — an article in The Times Educational Supplement 13 7 73

The statelessness of the art

I wonder how many will have echoed Arthur Wardell's words and sentiments? (Letters, February) No doubt he has been advised time and time again to take his queries to his local dealer Few people have local dealers of any standing and those that have are likely to stand in a queue for some time and then be brushed off rapidly when it is evident that all they are seeking is information

What many small scale users try to find out is How much can the basic package such as the Pet and TRS80 with cassette storage do? Not many such people are interested in storing telephone numbers Christmas card lists cookery recipes birthdates etc at such phenomenal cost They are more likely to want to know whether the micro-computer can store and retrieve rapidly much more extensive information and whether it really can help in the education of their children

Education always features in the hardware advertisements but the available software seems to be incredibly limited I have found nothing more than a cassette or two on basic mathematics and a few on higher grade engineering or scientific subject

I have tried the following application out on one major advertiser and after 30 days so far have received no reply (and incidentally no goods ordered at the same time)

The task is editing an encyclopedia of about 2000 entries and more than a million words Can these be kept track of by the basic computer without expensive additions such as floppy disc units? The editor needs to know title of entry author section editor entries received outstanding edited to be edited being revised revised number of words and lines for each entry and of course he needs to be able to access any entry or group of entries rapidly (or reasonably so) and to update the information constantly

Can cassette storage do anything like that? I would think not from what I have read so far if only because it seems that access to cassette information is slow But how slow? I quote from one book It could take 10 or 15 minutes to reach the last record on a cassette In that case disc storage is presumably essential and the cost of the initial hardware becomes ridiculous when a good card index system could be reasonably efficient

The question then remains. Can the basic microcomputer really do anything more than store simple information act as an advanced calculator play games and provide hours of quite valid enjoyment for the enthusiast with money to spare?

Leonard Gaunt, 44 Hatherop Road, Hampton, Middlesex TW12 2RF.

Posthumous processing

To provide a decent and fair balance to the growing amount of articles and books describing the effects of microchip technology on employment I am compiling a directory which would be called Is there life after Automation?

I would be grateful for any suggestions on how we can re employ those clerks and secretaries displaced by the microchip and how we shall profitably spend our increasing hours of leisure Humorous and serious replies welcome

Anthony Heskin, 3 Witham Road, Osterley, Middlesex.

The Queen's English

I have read No 3 and have thoroughly enjoyed it Please don't make the mistake of most of your competitors in assuming that all your readers are Computer B Sc's I for one want to know the know-how in simple Queen's English A C P U is an example of the common way of saying central processing unit By itself that is not bad but when every sentence contains an abbreviation of some kind or another then I give up Keep it logical — keep it simple and I am sure you will attract the not so-technical reader

Arthur J Likeman, 'Collingwood", 19 Sandy Lane Shoal Hill, Cannock Staffs WS11 1RF

Debugging the editor (1)

I welcome heartily the appearance of your most interesting and competent publication and wish you every success However I cannot see what is to be gained by taking sides in cold war polemics (Editorial issue 4) I believe that this is best left to publications which specialise in international politics the Editorial of a specialist computer journal ought to make some astute comment on the industry and the state of the art

If the political implications of the use of computers are to be explored then please at least be thorough Mention the use of the computer by the intelligence services of all super powers in the United States details of all passports issued in the western world are available from a computer bank an American firm which is involved in computers took an active part in the overthrow of the elected government of Chile replaced by a regime hardly less oppressive than the Soviet one your Editorial complains of.

If Afganistan shocks we should remember that *all* superpowers intervene in the affairs of their neighbours Chile Dominican Republic Bay of Pigs Vietnam etc etc etc One computer exchanged for Christmas cards (or anything else) can have no significant effect on the balance of power it is no different to swapping for example Coca Cola for nickel ore

Please Computer Age keep out of the political mine-field It is not your area of expertise

Arthur L Caler, 22 Sunnymead Road, London SW15

Debugging the editor (2)

May I comment on this relatively new magazine I first read about it in the "TIMES" survey on computers

Out of curiosity I acquired the current issue (No 4) and I must say I find the magazine extremely useful and comprehensive

However the editorial (issue 4) did not match most of the brilliant articles featured Quite a few of us in the University found it lacking in depth and out of character with the rest of the magazine

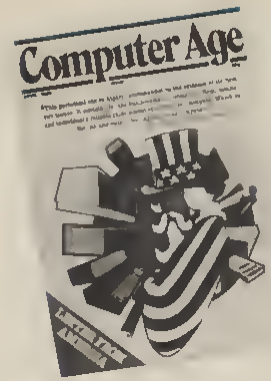
We feel that personal political views and in fact political issues in general are best kept out of the magazine

S Odunlan 4 Burnham Lodge Kise Park Nottingham NG5 5BX

Better late

I take this opportunity to say that I love reading the magazine and only wish it was started earlier

Sukhtave Singh, 3 Fencepiece Road, Hainault, Essex



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To continue subscript on détails are on page 70 '

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